August 19, 1920 **American Machinist** Vol. 53, No. 8

Machining Monel-Metal Castings

BY A. J. HANLON
Technical Department, International Nickel Co.

Monel metal is being put to many uses, the number of which is constantly increasing. Any collection of facts relative to machining this metal is a worthy addition to our present rather incomplete information. The article here presented furnishes specifications for lathe tools for turning and threading monel-metal castings. There is also information concerning lubricants.

MONEL metal is an individual alloy possessing distinctive machining qualities. Castings, when machined on the lathe, require tools with rounded cutting edges, pronounced back slope, or top rake, and keen cutting angles; also a first-class quality of high-speed steel properly hardened and tempered, and comparatively low cutting speeds. Ease of machining is a function of the physical properties of a metal. Experiments made in our own laboratory indicate that cast monel requires more power to machine than mild steel. This power comparison should not be confused with machining methods for these two metals as they are entirely dissimilar.

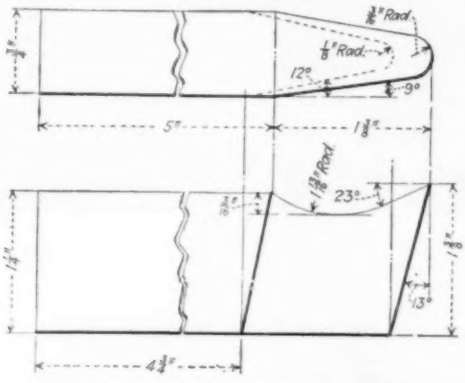


FIG. 1. LATHE ROUGHING TOOL

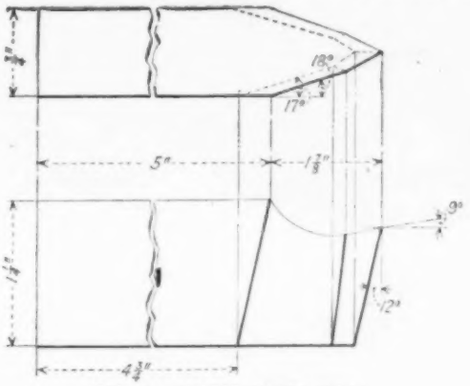


FIG. 4. THREADING TOOL

ANGULAR SHAPES OF TOOLS

Cast monel, due to its extreme toughness, requires tools with keen cutting angles. This necessary keenness may be best obtained, without weakness of cutting edges by grinding the lathe tools with certain angular shapes. Tools so shaped permit the use of higher cutting speeds with a minimum of regrindings, both factors of extreme importance in economical shop production practice.

In Figs. 1 to 4 the important angles for roughing and threading tools (both solid tools and tool bits) are specified. The use of a toolholder with ¾-in. and ⅝-in. bits in itself furnishes sufficient top rake without grinding. The Armstrong toolholder, for example, holds the bit at a 30-deg. angle.

The roughing tool (Fig. 1) is ground with a 13-deg. clearance angle and 23-deg. top rake. The nose is tapered gradually at an angle of 9 deg. from a plane parallel to the side of the tool and the cutting edge is rounded, with ⅜-in radius. The sides on the nose are ground with gentle slope from top to bottom to obtain the 9- and 12-deg. angles shown. Both angles are measured from a plane parallel to the side of the body of tool. Cast monel metal when turned, gives a long, tough chip. The large rake or back slope ground in the roughing tool helps materially to get rid of this chip by curling it. In that way it is prevented from concentrating the heat generated over the least sectional area (the lip surface), resulting in greater life under working conditions. The clearance angle is made small for the purpose of strengthening the tool, in fact, just large enough to preclude any possibility of rubbing the flank of the tool against the work. When machining a casting with a particularly hard outer skin, the cutting edge may be more blunt with beneficial results. This is secured by grinding the flank of the tool. A tool of this description has less tendency to cut cleanly but is stronger, better withstanding the hard knocks encountered in cutting the skin of any casting, due to sand holes or surface defects.

For either ¾- or ⅝-in. bits, Figs. 2 and 3, the clearance

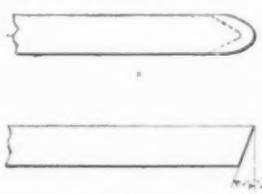


FIG. 2. ¾-IN. ROUGHING TOOLBIT

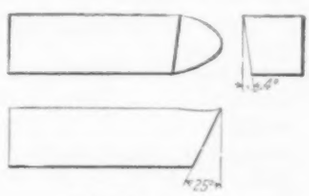


FIG. 3. ⅝-IN. ROUGHING TOOLBIT

angle must of necessity be larger than that for bar stock tools, due to the position in which these are held in the toolholder. As no top rake is ground in the tool, this larger clearance angle of 25 deg. does not weaken it. With a ⅛-in. bit, 4-deg. side slope should be ground back from the cutting edge in order that the chip may better free itself.

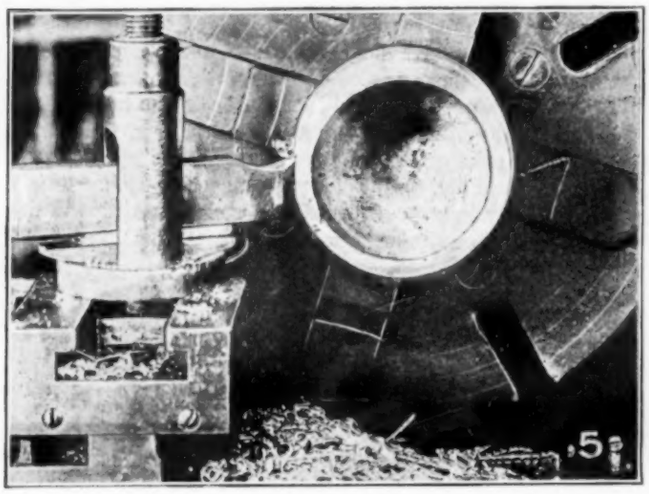
The threading tool, Fig. 4, on account of its pointed cutting edge, has a greater tendency to crumble. For this reason, rake and clearance angles are decreased to 9 deg. and 12 deg. respectively. Side rake, 17 deg. and 18 deg., is measured from a plane parallel to the side of the body of the tool and is obtained by grinding the side of the nose on a gentle slope from top to bottom. The point of the tool may be ground for any standard thread desired.

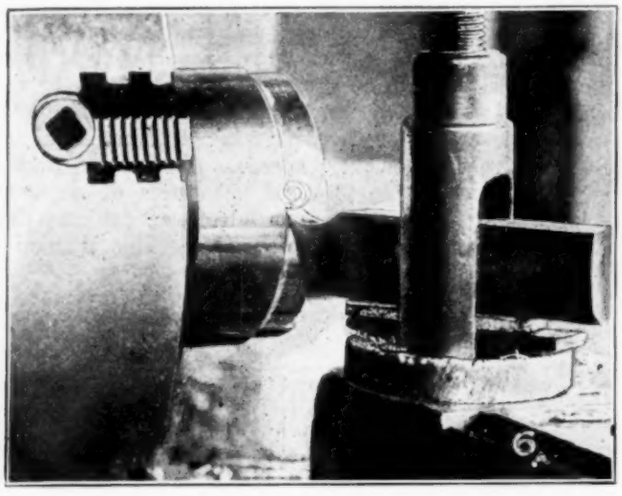
The best method of dressing the tool is to turn up the nose or point ⅛ in. above the body of the tool. By plunging it into fish oil. The temper was then drawn at 1,000 deg. F. (dark red) the tool being allowed to cool slowly in a closed box. Tempering the tool relieves the strains in the metal, giving it a tough rather than hard cutting surface and materially lessens the number of regrindings necessary for a given amount of work. This hardening procedure follows the general course as laid down for the majority of high speed steels.

Among the high-speed steels which have given satisfaction in cutting cast monel metal, are the Maximum 000L, Peter A. Frassee and Co.; Triple Mushet, B. M. Jones and Co. and Rex AA, Crucible Steel Co. of America.

Grinding Tools

The tool should first be ground on a dry emery wheel, not being held firmly against the wheel but moved over its surface. The wire edge should be removed on either





FIGS. 5 AND 6. TURNING A MONEL-METAL PLUG ON AN ENGINE LATHE

so doing the maximum number of regrindings with one dressing may be obtained. The roughing tool shown in Fig. 1 is correctly dressed. The threading tool shown in Fig. 4 has been ground a number of times. With an equal number of grindings the roughing tool would assume a similar shape, in the relation of the nose of the tool to the body. Tools should leave the smithshop with approximately the same angles as the finished tools are to have, to avoid waste on the emery wheel. Forging temperatures for most high-speed steels lie between 1,750 and 1,850 deg. F. (yellow heat). During forging operations the temperature should not be allowed to drop to less than 1,600 deg. F. (light cherry or red). In Figs. 1 and 4 the noses are shown dressed straight with the body of the tool. For greater facility, when machining small castings, it is good practice to turn the nose of the tool to the right through an angle of 45 deg. from a plane parallel to the side of the body of the tool.

Hardening and Tempering

On account of the toughness of cast monel, it is very essential that the high-speed tool steels used in machining should be tempered or toughened after initial hardening. With one particular steel, namely Maximum 000L, excellent results were obtained with the following heat treatment. The temperature was slowly raised to 1,800 deg. F. (yellow heat) and then quickly to 2,300 deg. F. (white heat) and the tool cooled by a common wet grindstone or an oilstone. Care should be taken not to burn the cutting edges. The sides of the flank should be ground first, then the lip or rake angle, and finally the edge should be rounded. On subsequent grindings, approximately the same angles should be retained.

Feeds as shown in the table are recommended. These figures are based on the experiences of a large number of firms. They are for dry cutting. Cooling solution permits the use of higher surface speeds. It will be noticed that a good average speed of 60 in. per minute, ⅛-in. cut and 1/32-in. feed should be used. To secure a better finished surface, a light cut may be taken with small feed and high speed.

The tool should have a true solid bearing on the tool

FEEDS AND SPEEDS FOR TURNING

Cut-Inches	Feed-Inches	Cutting Speed Feet per Minute
⅛	1/32	150
	1/16	120
¼	1/32	100
	1/16	90
	⅛	75
⅜	1/32	85
	1/16	70
	⅛	50
½	1/32	75
	1/16	60
	⅛	45
	¼	40
¾	1/16	50
	⅛	40
	¼	30

support, which should extend as nearly as possible to a point directly beneath the cutting edge. The body of the tool should be greater in height than in width. The cutting edge should be set slightly higher than the center of the work to obtain the greatest shearing effect. No hard or fast rule can be laid down, as this height will differ with varying diameters. On small work where a full cut must be taken, with the danger of a dog or chuck interfering with tool carriage before its completion, the roughing tool may be set on an angle up to 30 deg. For threading all the way to chuck or dog, a threading tool dressed with nose offset should be used.

LUBRICANTS

For ordinary lathe work, cast monel metal may be cut dry very satisfactorily. The use of a lubricant is sometimes preferable. Among those on the market that have been found to give excellent results are: For cutting, Houghtons' Soluble Oil, 1 gallon to 10 gallons of water, E. F. Houghton & Co.; Equinox No. 1, Lindsay McMillan Co.; Oakite, Oakley Chemical Co. For threading, Cresol No. 1 Soluble Oil, emulsion of 15 parts water to 1 part creosol No. 1. For cutting and threading, Top Cutting Oil, Frontier Manufacturing Co. For general work, machine oil.

EXAMPLES OF WORK DONE WITH TOOLS RECOMMENDED

In Figs. 5 and 6 are illustrated the turning operation on monel-metal plugs which have successfully replaced bronze plugs, in connection with Burton's gasoline stills used in the petroleum refining process. The two machining operations necessary, turning to size and threading, are done on an engine lathe. The plug casting is gripped on the square head by a 4-jaw chuck. The tool is turned sidewise at an angle of 30 deg. to prevent interference of chuck and carriage. There is little tendency to dig in, and a wide, tapered chip is removed, thinnest at the finishing point.

A $\frac{1}{4}$-in. cut is taken with $\frac{1}{32}$-in. feed at 60 surface feet per minute. The point of the tool is set $\frac{1}{8}$ in. higher than the center of the work, to obtain the maximum shearing effect. A cut of this size is, in most cases, sufficient to allow the cutting edge of the tool to penetrate under the tough skin of the casting, into the more uniform metal beneath.

The great advantage of the top rake in the lip surface of tools is clearly shown in Figs. 5 and 6. The chip is curled and thrown to one side with the least injury to the cutting edge. Keenness of the cutting edge is thus retained over the longest period of time with resultant good surfacing.

For the threading operation a tool with the nose turned to the right at an angle of 45 deg. is used. The finished thread is completed in three or four passes. The chip curls up very much as does the chip from the roughing tool.

A Well-Developed Technical High School

BY FRED. D. HOOD
Head of Mechanic Arts Department of Los Angeles Polytechnic High School

The work of training young men for the machine business in these days is a very absorbing and important subject. The part which our public schools, some of them at least, are contributing to this end makes it reasonable to expect for the future a better grade of mechanic than is produced by our present-day apprenticeship system, if, indeed, there is such a thing. The latter remark, of course, does not apply to the results obtained in some of our large and long-established concerns, which are both effective and, to some extent, philanthropic. Their chief fault is that they are not numerous enough. For a full and systematic training in the machine business, and in other lines as well, so far as a thorough groundwork in the leading principles and a well-rounded education is concerned, the public school, in my opinion, can do more effective work and can do it on a larger scale than can any other organization at present.

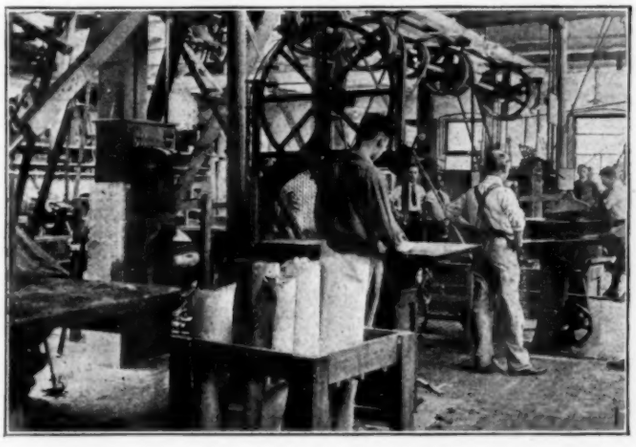


FIG. 1. THE WOOD SHOP AND PATTERN SHOP

FIG. 2. STUDENTS AT WORK IN THE FOUNDRY

The Los Angeles Polytechnic High School was established at its present location in 1905, the Mechanic Arts Department consisting of a woodshop and patternshop 60 x 70 ft. in size, a forge shop 30 x 70 ft., a foundry 30 x 70 ft. and a machine shop 60 x 70 ft. A mechanical and electrical engineering laboratory 40 x 100 ft. in size was added in 1911, much of the equipment for it being made in the school shops.

Fifteen separate four-year courses comprise the curriculum of the school and for two of these, mechanical engineering and vocational machine shop, the major work is given in the Mechanic Arts Department. The object of the former course is to give good, sound training in the elementary principles of the design and construction of general machinery, including steam and gas engines, pumps and the machine work connected with dynamos and motors. In the latter course the

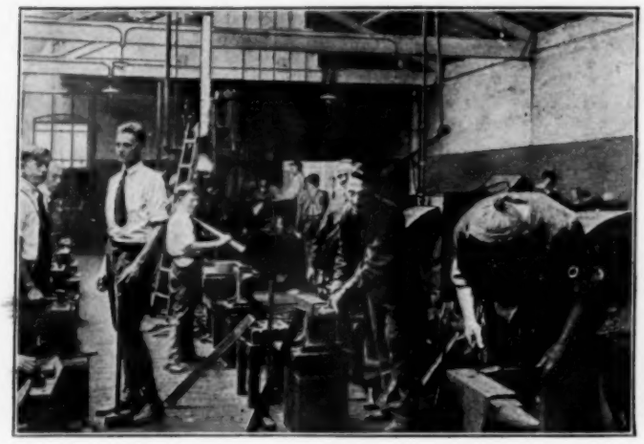


FIG. 3. ACQUIRING FIRST-HAND INFORMATION ABOUT BLACKSMITHING

FIG. 4. VIEW OF THE MACHINE SHOP WITH THE STUDENTS AT WORK

work is confined largely to Simon-pure machine-shop practice, meeting the requirements of the Smith-Hughes Act. The engineering laboratory, which is perhaps unique in schools of this type, gives good opportunity for the application of shop practice in the installation, adjustment and operation of machinery, as well as furnishing an incentive to the machine-shop students for the building of machines and equipment.

Properly correlated mechanical drawing, mathematics, physics and other technical studies, as well as the academic subjects, round out and balance these courses.

A large majority of high school students either drop out of school, or, if they do complete the course, never carry their systematic training any further. This makes it incumbent upon the school to offer a course which gives the greatest measure of usefulness, in terms of earning capacity, for the time spent. Such a course should be self-contained in every step and capable of being turned to practical use at any time as contrasted with a course which bears fruit only after an extended and tedious process.

While a boy should get all the training he can while the getting is good, attend the best university in the country and graduate if possible, the best provision we can offer should be extended to that large number who we know will never gain the high institutions, yet who are, in the main, altogether worth while. Judging from the experiences of those students who have gone out from the school, this kind of thing is reaching the people, for not a few return, either to complete their course or to take advanced work in the same line.

The school runs practically twelve months in the year, night and day. It enrolls over 2,100 pupils in the day school and over 3,000 pupils in the night school and is free to all.

The accompanying illustrations show some views of the shops and of the kind of work being carried on.

Why the Blueprint?

BY L. N. GILLIS

I have noticed articles by several contributors on the question of "Why the Blue Print?" the first one being by Frank Richards on page 871, vol. 52 of the *American Machinist*. It seems to me that, so far, your contributors have all overlooked one of the best ways for making drawings for use in the shop. I refer to the reproduction of drawings by the direct photographic copying process, as done with the photostat and other like machines.

During the war, it was my fortune to have charge of the drafting office of the National Research Council. When I took charge of the office, I found the sizes of drawings, prescribed by the man who had started the work, were standard sizes adopted from the drawings used in a sewing machine factory. I also found that the institution possessed a photostat machine of large size, and it was a simple matter to establish sizes for the drawings that would correspond with the standard sizes on the photostat scale. Then the drawings, either pencil drawings or tracings, could be laid on the photostat board and all reduced to 18 x 22 in., or a half or quarter thereof. When using the half size either two prints were made at a time or the half-size shield was put on the photostat. This method enabled as many reproductions to be made directly from the drawing as were necessary for our purposes; and, in addition, if a change was made on any drawing, the same could be reproduced without making a new zinc plate or a new photographic plate, since the printing was done directly on the photostat paper.

Moreover, the cost of this work is very little more than the cost of the ordinary blueprint, and is certainly much less than would be the case with any small number of reproductions made by either a zinc-plate process or a photographic process on glass to any reasonable size. There is a happy medium between a small photograph and a blanket-sized blueprint that can very readily be reached with the photostat; and, in addition, it is possible to do with this latter class of reproduction all that can be done with either the zinc- or photographic-plate process without requiring the lines and figures to be made abnormally large and heavy, since the drawing reproduced in this way to a size 18 x 22 in. comes out very distinctly, even though the drawing itself may be 48 or even 60 in. long. Again, convenient portfolios may be made up, all of 18- x 22-in. size, showing all of the drawings for any particular machine or apparatus.

Of course, it is to be understood that, where small details are made, they can either be photographed to full size or reduced from the original by placing a number of them on the printing board of the photostat. There are a number of machines of this class in the market, and, so far as I can find out, are all about equally good, and the operation is extremely simple in almost every case.

Superchargers for Airplane Engines*

By SANFORD A. MOSS
West Lynn, Mass.

A supercharger supplies air to the carburetor at sea-level pressure in high altitudes, thereby maintaining the engine power at sea-level value, and causing a considerable increase of speed.

AN AIRPLANE flying at high altitude is in an atmosphere of comparatively low density. For instance, at 20,000 ft. altitude the density is practically half that at sea level. This means that a given volume contains half as much actual air by weight. The cylinders of an airplane engine are therefore charged with an explosive mixture which has about half the value of a charge at sea level. The engine actually delivers about half of its sea-level power at 20,000 feet. At high altitude the resistance of the air to the motion of the airplane is decreased directly in proportion to the decrease of density. The power required for a given airplane speed is therefore greatly reduced. However, the engine power has been so reduced that the usual net result is a considerable decrease in airplane speed. When the engine power is maintained at the sea-level value, there is, however, a considerable increase of speed at high altitude. Filling the cylinders of an internal-combustion engine with a charge greater than that which would normall yoccur, is called "supercharging."

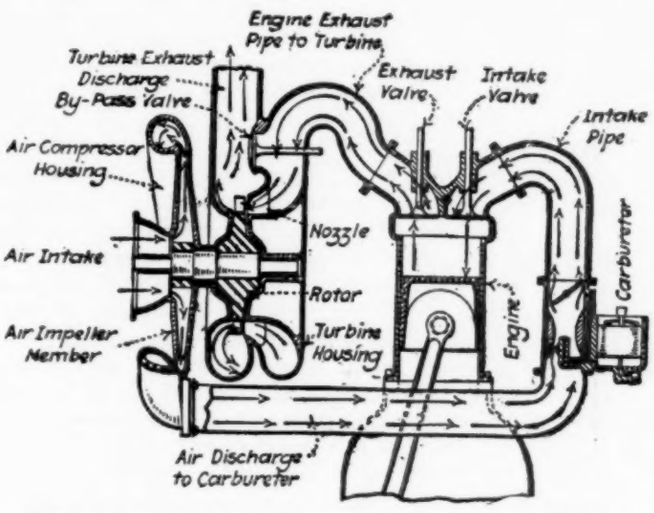


FIG. 1. DIAGRAMMATIC SKETCH OF AN AEROPLANE ENGINE EQUIPPED WITH A SUPERCHARGER

The centrifugal compressor is an apparatus similar to the fan blower except that the shape of the impeller blades and the passages leading air to and from the impeller are so arranged as to give efficiency very much greater than that of the usual type of fan blower, so that the apparatus forms a satisfactory means for compressing air to appreciable pressures. A line of single-stage centrifugal compressors has been developed for compressing air from 2 to 5 lb. per square inch above atmosphere, to be used for many industrial purposes; as well as a line of multi-stage machines for compressing air and gas up to pressures of 30 lb. per square inch above atmosphere.

The turbo-supercharger is a combination of a gas turbine and a centrifugal compressor, arranged as part of an airplane gasoline engine. The hot products of combustion from the engine exhaust are received upon the turbine runner and furnish power whereby is driven a centrifugal compressor mounted on the same shaft, which compresses air for supply to the carburetors. In Fig. 1 is shown an airplane engine equipped with a turbo-supercharger. The exhaust of the engine is received by an exhaust manifold which leads it to a nozzle chamber carrying nozzles which discharge it onto the buckets of a turbine wheel. On the same shaft with the turbine wheel is the impeller of a centrifugal compressor. This compresses air from the low-pressure atmosphere to approximately normal sea-level pressure and delivers it to an air-discharge conduit which supplies the carburetors.

The turbine nozzles are of such area as to maintain within the exhaust manifold and nozzle box a pressure approximately equal to that at sea level. The difference between this pressure and the altitude low order to avoid back pressure drop for the exhaust gases which furnishes the power that operates the system. Due to the respective temperatures this power input suffices to give the desired compression and also to supply the inevitable losses. However, in order to avoid back pressure on the engine, above the normal sea-level value, both turbine and compressor must be designed with utmost attention to efficiency. With an efficient arrangement the engine when at high altitude exhausts at normal sea-level pressure and receives its air at the carburetor at normal sea-level pressure. Hence, normal sea-level power is delivered at all altitudes up to the maximum for which the supercharger is designed, so that the plane speed will increase uniformly as the altitude density decreases.

The General Electric superchargers thus far constructed have been designed to give sea-level absolute pressure at an altitude of 18,000 ft. which requires a compressor that doubles the absolute pressure of the air.

This pressure ratio, with the quantity of air involved, means about 50 shaft-horsepower input for the compressor. The design of a complete power plant of this size to suit an existing airplane engine, with such weight and location as will not impair the flying characteristics of the plane, has, of course, offered many problems. The possibility of driving the compressor of the supercharger by engine power, instead of by the exhaust gases suggested itself. Much experience with the operation of the gas turbine, however, led the writer to prefer its problems to those of the driving mechanism of a supercharger operated from the engine. The turbine involves merely the addition to the compressor of a single extra wheel, designed for the con-

*From an extract published in *Mechanical Engineering*, of a paper on "The General Electric Turbo-Supercharger for Airplanes," contained in the May, 1920, issue of the *General Electric Review*.

ditions, with no extra bearings. The engine-driven scheme involves a 50-hp. transmission with a multiplicity of gears, bearings, clutches, belts, and the like. These offer more or less drag on the engine when the supercharger is not in use at low altitudes, and very serious problems of acceleration when the supercharger is to be thrown into action, since the engine will be then running at its full speed of about 1,800 r.p.m.

The exhaust manifold and nozzle box have proven to be a very efficient exhaust muffler and conductor. Such a muffler and conductor are needed in any event, and the design of means for withstanding the increased pressure difference of the turbo-supercharger has been successfully accomplished.

Power for Turbo- and Engine-Driven Superchargers

An efficient turbo-supercharger theoretically deducts from the indicated-horsepower of the airplane engine an amount corresponding to the difference between sea-level absolute pressure and altitude pressure. There is this additional back pressure during the exhaust stroke. The theoretical power available for driving the turbo-supercharger is greater than this, however, owing to the fact that there is available not only the energy due to the direct pressure difference mentioned, but also the energy of perfect expansion from the higher to the lower pressure. If there were no turbo-supercharger the engine would waste this energy in sudden pressure drop as the exhaust valve opens. The turbine can utilize this energy. The sum of these two amounts of available energy, multiplied by the efficiency of the turbine wheel, gives the shaft power delivered to the compressor.

For an engine-driven supercharger compressor there is greater engine indicated power due to a lower exhaust pressure. However, the shaft power for the super-charger compressor must be transmitted through the engine connecting rod and crankshaft, with losses, and then through the supercharger driving mechanism with additional losses. The total shaft power thus subtracted from the engine, multiplied by the efficiencies of these two transmissions, gives the shaft power delivered to the compressor. This is the same as for the turbo-supercharger. For a Liberty motor of 400 hp. and sea-level power at 18,000 ft. altitude, this power is 50 hp.

The comparison, then, is as follows: The turbo-supercharger subtracts from the engine indicated power, adds power of expansion which would not otherwise be used, and has turbine wheel losses. The engine-driven supercharger puts this indicated power through the engine (with some additional loads on the pins and bearings) and has engine and transmission losses.

With usual efficiency there is probably not a great difference between the gross subtraction from engine power in the two cases. There is then the disadvantage of transmitting the supercharger power through the engine pins and bearings, as well as through some mechanism between engine and supercharger, to be compared with the collection of the hot gases under pressure (with muffling advantages) and delivery to the turbine wheel. As already mentioned, practical success to date is in favor of the turbo-supercharger and the writer feels that this is really due to its innate superiority.

Engine-driven superchargers with positive-pressure blowers have been proposed. These have the additional disadvantage that with the desirable pressure ratios of about two to one there is an appreciable compression loss due to the fact that the machine only displaces air and has no direct means for compression.

Supercharging engines of various kinds, in which the engine crankcase or the engine cylinders themselves are arranged for additional compression, have been shown to give excessive weight and complication as compared with a turbo-supercharger.

Development of the Turbo-Supercharger

The machines used thus far have been designed to give sea-level pressure at 18,000 ft. altitude, which corresponds to a pressure ratio of about two. The rated speed for these conditions is 20,000 r.p.m. Sea-level pressure has readily been obtained up to 22,000 ft. altitude. The control is entirely by hand operation of waste gates, which permits of free escape of some of the exhaust gases.

The entire apparatus, exclusive of exhaust manifold and air-discharge conduit, weighs about 100 lb. The exhaust manifold and air conduits have nearly the same weight as equivalent parts with no supercharger.

The turbine and compressor wheel have diameters somewhat less than a foot. The present design has been hampered by necessity for accommodation to existing engines and planes. It is proposed, however, to construct apparatus in which engine and supercharger are integral, with all parts arranged for the full possibilities of the combination.

In the combination under consideration the airplane, propeller, engine, radiator, cooling system, and supercharger are so intimately associated that no adequate tests can be made without the complete system in operation at full speed at altitude. During the initial development of the Liberty motor a testing expedition had been sent to the summit of Pike's Peak, and it was decided to repeat this performance with the supercharger. Fig. 2 shows the motor truck that was prepared for the expedition and Fig. 3 the way it was left after each day's work. The Liberty motor carrying the supercharger was mounted on a cradle dynamometer, with scales and all arrangements for accurate measurement of power, gasoline consumption and the like. In fact, a complete testing laboratory was provided. The motor truck was shipped by rail to Colorado Springs, and then proceeded by its own

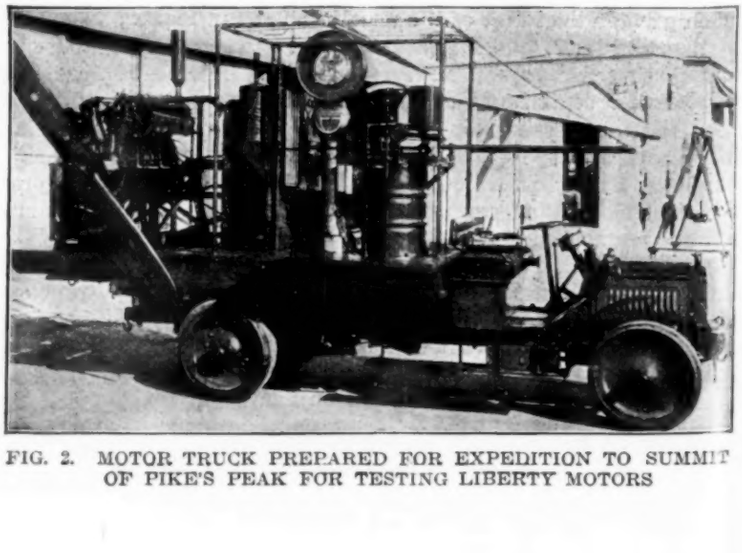


FIG. 2. MOTOR TRUCK PREPARED FOR EXPEDITION TO SUMMIT OF PIKE'S PEAK FOR TESTING LIBERTY MOTORS

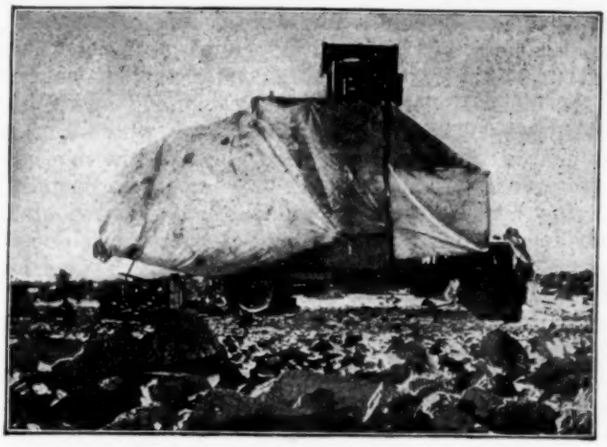


FIG. 3. SHOWING WAY IN WHICH MOTOR TRUCK OF FIG. 2 WAS LEFT AFTER END OF DAY'S WORK

power to Pike's Peak summit on the "Pike's Peak Auto Highway," a well-constructed but very tortuous mountain road 28 miles long. The summit has an altitude of 14,109 ft. and it is the highest point in the United States easily reached by road.

The testing work at the summit lasted through September and half of October, 1918. The usual difficulties with experimental work were, of course, encountered with the addition of many delays, due to the cold and snow, and distance from repair shops. The apparatus was finally arranged to give good mechanical operation and it was found possible at the existing altitude of 14,000 ft. not only to supercharge so as to give full sea-level power, but also to overcharge so as to cause the engine to preignite.

It was agreed that results of the tests warranted the immediate installation of the supercharger on an airplane, and arrangements for doing this were in progress when the armistice caused a cessation of the work. After the armistice, careful re-examination of the situation resulted in resumption of the work in the early part of 1919. Various rearrangements were made in view of the experience gained at Pike's Peak and the apparatus was finally installed on an airplane. After a number of tests on the ground, flight tests were made.

It soon developed that a very appreciable increase of power was easily obtained when the supercharger was opened up. The whole airplane installation was not properly arranged to take advantage of this power, however, and changes were necessary in the radiator, cooling system, propeller system and gasoline tank.

Supercharger Performances

The supercharger which has been used to date in flight tests was primarily desired for high speeds at altitudes of 18,000 to 22,000 ft. The Le Pere plane on which the installation was made had a ceiling of about 20,000 ft. with two men, and a speed at this altitude of 70 miles per hour. With the supercharger in use, a speed of about 140 miles an hour has been attained at 22,000 ft. As already pointed out, this has been attained with various parts of the plane installation in a partially developed state. Theoretical computations have been made showing that much higher speeds at high altitudes are to be expected. The progress of the flight tests to date indicates that the theoretical expectations will be fully realized.

The making of high altitude records has been very attractive and the supercharger has, of course, been used for this purpose as well as for the speed courses mentioned. Successively higher altitudes have been reached as experience has been gained regarding the manipulation of oxygen, gasoline, and other details.

On Feb. 27, Major Schroeder made a flight alone, attaining an actual height above the ground finally computed as 36,130 ft. (6.85 miles). The lowest temperature reached was minus 67 deg. F. At the maximum altitude his oxygen apparatus failed and he became unconscious and lost control of the plane, which fell almost vertically. As he neared the earth he partly recovered consciousness and, at an altitude of about 3,000 ft., succeeded, in a half-dazed semi-automatic way, in righting the plane and making a good landing in his own field, again becoming unconscious. He was taken to a hospital in a serious condition, but has since almost completely recovered. The supercharger, engine, and plane were in perfect working order after the flight.

At the maximum altitude attained, recording instruments showed that the plane was still climbing at the rate of about 125 ft. per minute and it was estimated that an altitude of 40,000 ft. would have been attained if the oxygen apparatus had not failed.

In the May issue of the *General Electric Review* there also appears a reprint of a paper on "Superchargers and Supercharging Engines," by Major George E. A. Hallett, U. S. A., presented at the annual meeting of the Society of Automotive Engineers, Jan. 7 and 8, 1920. Major Hallett, who is Chief of Power-Plant Division, U. S. Air Service, deals at some length with the various methods employed in supercharging and refers to the work of the U. S. Air Service on the Rateau type of turbo-compressor, under the supervision of E. H. Sherbondy, prior to that undertaken by Dr. Moss. Commenting on the working of the Moss supercharger, he says:

> It would naturally seem at first thought that the extremely low temperatures always found at great altitudes would make possible the easy solution of cooling problems, but in reality the low density of the air reduces its heat conductivity and capacity for heat absorption to such a point that a supercharged engine developing sea-level power at 20,000 ft. requires a little *more cooling surface* than it does when developing normal power at sea level.
>
> The Liberty engine and many others run best with a water temperature of about 170 deg. F. To maintain the cooling water at this temperature in the reduced atmospheric pressure at 25,000 ft. it is necessary to use several pounds of air pressure in the radiator to prevent the water from boiling away. Very effective radiator shutters are needed when the engine is throttled to make a descent from altitudes over 20,000 ft. to prevent the water in the radiator from freezing before warmer air is reached.
>
> Contrary to expectations, the Moss turbo-compressor now being tested at McCook Field does not complicate the pilot's controls. On a normal engine the pilot handles the throttle and the altitude carburetor control which thins down the mixture as he ascends. With the turbo-compressor the altitude control becomes unnecessary up to the altitude at which the engine can no longer deliver sea-level power but is used, as with a normal engine, if the plane is driven higher.

As to the future of the supercharger, Major Hallett says:

> The uses of the supercharger for military service can be divided into: First, for airplanes in which it is desired to reach extreme altitude; second, for airplanes in which it is desired to increase the rate of climb and horizontal speed and therefore maneuverability at altitudes where it is intended to fight; and, third, for airplanes which carry large loads such as bombers, which normally are handicapped by

having a very low ceiling and whose entire usefulness would, if larger engines were installed to pull them to a higher ceiling, be lost on account of the large amount of fuel and other material that would have to be carried, thus decreasing their radii of action.

In the first case it is believed that a special supercharger can be built that will make feasible much greater altitudes than any that have been attained with the present General Electric turbo-compressor; and it is considered essential that we have airplanes capable of reaching very great heights. In the second case, it is pointed out that military machines not fitted with supercharging engines, when fighting at an altitude of 20,000 ft. or more, are so near their ceiling that their rate of climb, speed, and maneuverability are comparatively poor, but the use of a supercharger seems to overcome this difficulty easily.

The use of superchargers in commercial airplanes of the future is assured because superchargers will make possible far *more miles per hour* and *more miles per gallon* with a given engine and airplane, and speed is the main advantage of air over other kinds of transportation. It is thought by many qualified judges that by flying at a sufficient height with a supercharged engine and a suitably designed airplane, a speed of 200 m.p.h. can be maintained.

In the heavy-load-carrying type of plane which must necessarily cross mountains or perhaps fly above storms and clouds, the necessary height can be reached with smaller, cheaper, and more economical engines if they are fitted with superchargers. It is obvious that in really long cross-country flights or trans-continental flights, with mail or passengers, the logical course is to fly at 25,000 or 30,000 ft. altitude where the resistance to speed is low and great speed can therefore be attained provided the engine can deliver high power economically, which it can do if equipped with a supercharger.

The Machinist and the Guard

By Val Klammer

Any mechanism exposed to hazardous contact is like a savage dog, harmless only when securely muzzled.

In the campaign against accidents much importance is placed upon the proper guarding of dangerous machinery, and it is only right that such should be the case; no one can deny that unguarded machinery takes a heavy toll of human life and causes much unnecessary suffering. If a man is injured by a train of gears, a guard over the gears will prevent many injuries to other men, but there is no magic charm about it, no guarantee that it will always effectively protect the worker. It is a fallacy to believe that any dangerous condition can be removed by the erection of a guard.

Safety in a machine shop is not obtained by simply placing guards on the machines, no matter how expensive the guards may be. The desirable state of safety and absolute freedom from accidents is only obtainable by guards plus something else, a something without which the installation of safety devices is but a waste of time, money and material.

A large machine shop in Pennsylvania was inspected by a state inspector who presented a voluminous report calling for numerous guards on the various machines. The management expressed its surprise in suitable terms, but finding that state laws demanded the guarding required gave its approval to the order. Thousands of dollars were spent on the guards and Mr. State Inspector finally pronounced the shop to be thoroughly guarded in accordance with the standards. Every gear, every belt and pulley, did its little bit inside a cage.

One year later Mr. State Inspector again appeared at the machine shop and presented a report which caused more consternation than the first. Of the many hundred expensive guards only a few were found to be intact; the rest were missing or in a badly broken condition. This made the management gloomily seek an answer to the eternal question "What's the use?" and think bitter things about the machinists for whose benefit the guards were installed. That is where the management made its big mistake; the guards were not installed for the benefit of the machinists but because state laws demanded it. The wastage of guards was due to the lack of one very important thing—the *co-operation* of the worker.

One curious fact which is repeatedly forced upon the attention of those engaged in accident prevention is that the first man to remove a safety device or render it ineffective is the man for whose protection the device is provided. A machine guard is primarily provided for the protection of the machinist, and yet he will frequently remove the guard and forget to replace it. This neglect or thoughtlessness is a serious matter; in the State of Pennsylvania the removal of a safeguard is considered a misdemeanor punishable by fine or imprisonment.

Employers have frequently accused workers of lacking interest in their own safety, and there is some degree of truth in the accusation, but it is not entirely through lack of interest that guards are lost or destroyed. The "take-a-chance" spirit is peculiarly American and is undoubtedly the cause of many accidents, but it is not this spirit which is chiefly responsible. The real reason is that there exists in every man a certain love for the old order and a distrust of the new, a preference for things as they have been for many years. Old "Bill" now runs a modern lathe but he has a secret longing for his old machine, the rattling product of a bygone age, and proudly tells of what he did, not what he does.

Opposition to safety devices is natural and should be looked for when any devices are to be installed, but the machine guard will never be of permanent value until the machinist has overcome this feeling of opposition. The first step in guarding any dangerous mechanism is not in designing the guard but in convincing the machinist that the guard is necessary for his safety and the safety of his fellow-workers. Before a safety device is installed it must be "sold" to the men who will profit by it. There is another reason for opposition to safety devices, a reason which is frequently overlooked by those who accuse the machinist of negligence—and that is the bad design of guards. No machinist can be expected to take great care of anything which interferes with production or prevents quick access to any part of the machine.

In the installation of machine guards new hazards are sometimes created. The guard may be placed too near moving parts and be caught and destroyed, or it may not give sufficient clearance to the machinist's hands while operating the machine. If a machinist pulls a lever or turns a wheel and lacerates his hands against the guard the great chances are that the guard will soon find its way to the scrap pile.

The ideal guard is strong and will not fall to pieces under the vibration and heavy usage of a machine shop; it is made of some material which will not obscure the parts guarded; it is well provided with doors to permit immediate access to the machine for the incidental changing of gears and the oiling of bearings. It takes the guard plus the co-operation to produce safety.

Some of the Shipbuilding at New Orleans During the War

By FRED H. COLVIN
Editor, *American Machinist*

Those who were busy making munitions of various kinds were not aware of the large amount of war work done in the Southern States. As an example New Orleans did its full quota in repairing and building ships at its various yards.

ONE of the well-known yards for ship repairs is the Johnson Iron Works, with its principal plant in Algiers, just a short ferry ride across the bend of the Mississippi from New Orleans proper. Here they handle a large amount of repair work and also have another yard for building hulls on Bayou St. John. Here were built some of the fabricated ships of the Emergency Fleet Corporation. Side launching was necessary owing to the lay of the land in this yard. Inclined runways are used in yards of this type as can be seen by views showing launching of the two boats.

Some idea of the difficulty of securing material can be had from the fact that the boiler shown in Fig. 1 was fabricated in Montreal, Canada, and the plates shipped to the Johnson Works for assembly.

The Johnson yard also built a number of good-sized tug boats, building the engines as well as the hulls. One of these engines is shown behind the propeller in Fig. 2. They are of the compound type and have an extremely large expansion ratio, the high pressure cylinder being 18 and the low pressure 38 in. in diameter, with 26-in. stroke. These engines develop 500 hp. with 150 lb. of steam, running at 112 r.p.m.

The propeller shown is a type which has been used quite extensively by the Johnson company, on account of its having removable blades so as to allow replacement

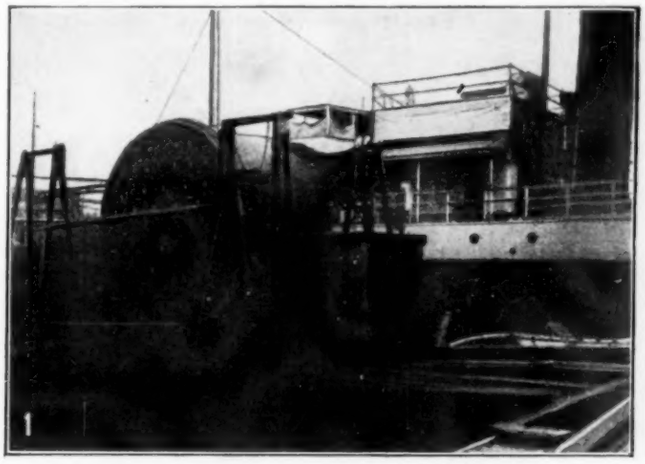


FIG. 1. BOILER READY FOR INSTALLATION

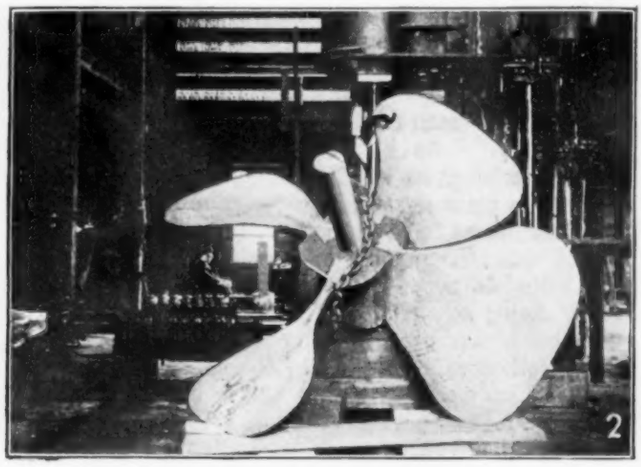


FIG. 2. PROPELLER AND ENGINE

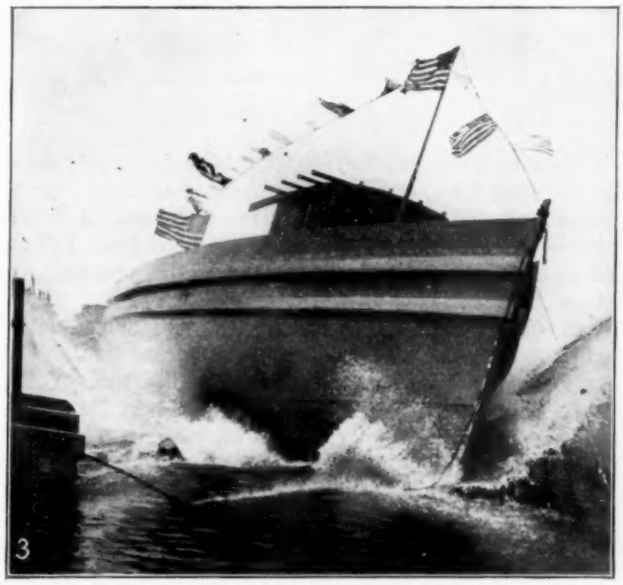


FIG. 3. A NORMAL SIDE LAUNCHING

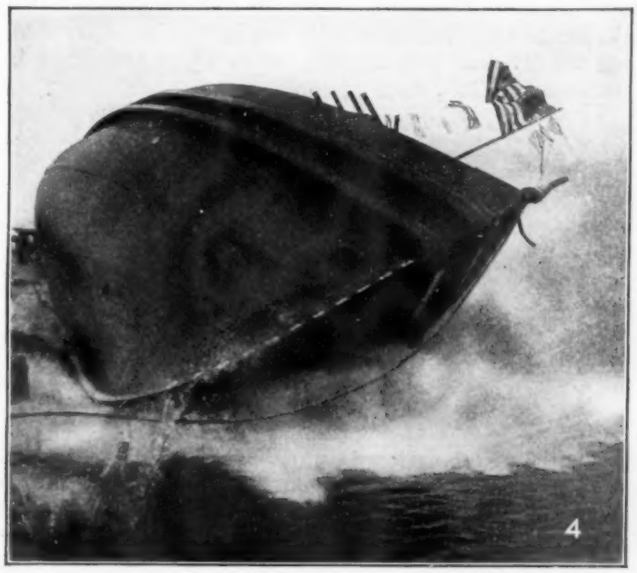


FIG. 4. ALMOST AN ACCIDENT

in case of injury to a single blade. The blades fit into a dovetail and are keyed into position, the keys being quite easily removed in case replacement becomes necessary.

Figs. 3 and 4 show two launchings of tugs, the first being a perfectly proper and normal launching of the tug "Delanco." This figure also shows the bottle used in christening still swinging from the bow. Fig. 4, however, shows what narrowly missed being an expensive accident, but which fortunately only caused a momentary scare, from which no damage resulted. This is the tug "Delaplaine," which is of the same design as the "Delanco."

This unusual launching was the result of one of the cradles slipping off the runway, which caused the hull to shift and roll into the position shown before striking the water. Fortunately it righted instantly and no damage resulted.

A Short Proof for Long Division

BY WALTER R. MEYER
Chief Tool Designer, R. K. LeBlond Machine Tool Co., Cincinnati, Ohio

Modern practice demands efficiency in all branches of work, and any method or idea tending to increase the production of any employee, in any capacity, increases the efficiency of the business. With this idea in mind, the writer wishes to submit the following method of proving long division, in the hope that it may give the designer, draftsman or tool engineer a short cut in his mathematics.

When I wish to positively prove a calculation I desire to see it in plain figures, thereby eliminating mistakes on slide rules or in the use of logarithms. The advantage of this method, that of simplicity, is self-evident, as it relies on nothing but plain addition for positive proof. Being so simple, I dare say that it is not new; but to the best of my knowledge it is not generally used.

The method will be shown by the use of the following numerical example. Dividing 1.25 by 0.98362, the quotient is 1.2708, with a remainder of 15704, as can be seen by the work given later. The proof of this would be 0.98362 times 1.2708, plus the difference 0.000015704, which gives 1.25, the original dividend. But this number has already been obtained in our division, so that the terms and final remainder can be totaled, disregarding the dividend and the remainders which are shown in italics in the following example:

```
0.98362) 1.250000000 (1.2708
         98362
         ------
         266380
         196724
         ------
         *696560
         688534
         ------
           802600
           786896
           ------
            15704
         ------
Proof:   1.250000000
```

Further explanation is unnecessary, but I may add that should there be a mistake in subtraction or multiplication it would show up in the addition and it would be in the column in which the first deviation of the sum from the dividend occurred, when reading from the right. For illustration, suppose that the remainder *696560* marked * in the example was, due to a mistake in subtraction, made to read *695560*. The result would be:

```
0.98362) 1.250000000 (1.2707
         98362
         ------
         266380
         196724
         ------
         *695560
         688534
         ------
           702600
           688534
           ------
            14066
         ------
Proof:   1.249900000
                 *
```

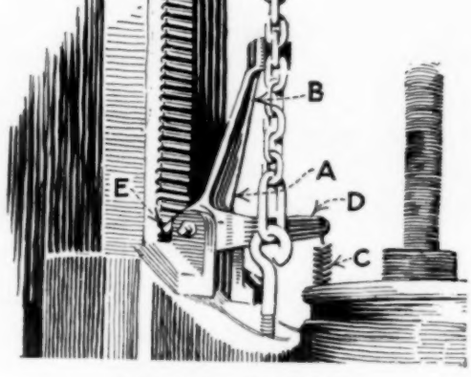
The appearance of the 9 in the total indicates a mistake in the column marked by the star, and the error in subtraction can be quite easily located. The writer hopes that others may find this method as useful as he has found it.

[Editor's Note. The preceding article appeared on page 157 of the July 22 issue of the *American Machinist*, and it is here reprinted on account of typographical errors printed at that time.]

Safety Device for a Multi-Spindle Drilling Machine

The *National Safety News* shows the accompanying illustration of a safety device applied to the head of a multi-spindle drilling machine.

The head of the machine carrying the drills, is supported by a chain, the other end of the chain having



THE SAFETY DEVICE

a counterweight attached to it. The head is raised and lowered by the usual rack and pinion.

As originally constructed, if the chain should break there would be nothing to prevent the head from falling and damaging the tools or injuring the operator or both.

The safety device consists of the two armed lever *A* pivoted to the head in the manner shown. The arm *B* is held against the chain by the pull of the spring *C* attached to the arm *D*. While in this position, the dog *E* is held clear of the rack teeth.

Should the chain break the spring would pull down the arm *D*, bringing the dog into the rack teeth. Downward movement of the head would cause the device to revolve until the arm *D* came in contact with the head, when the dog acting as a pawl would prevent the head from falling.

Chart for Computing Planing Time

By J. B. CONWAY

The construction and use of a chart for computing the cutting time required for planer jobs is covered in this article. The information is, of course, not new, but it is presented in a way which should make it of use to shop men.

THE accompanying chart is designed for rapidly computing the cutting time required for planing a surface when the other factors entering into the calculation are known, and from it the time in minutes or hours can be readily ascertained. In order to make such a calculation the following factors must be known: W the width in inches; L the length in feet; f the feed in inches per stroke; v the forward or cutting speed in feet per minute, and V the return speed in feet per minute.

W and L, of course, are determined by the dimensions of the part to be machined, f by the conditions presented by the construction of the part and the material to be cut, as is also v, the cutting speed, and V is determined by shop practice and the construction of the particular planer in question. For instance, several planers in the same shop may have different values for V, and the ratios of v to V, or the forward to return speed of the planer platen will vary accordingly, as 2:1, 3:1 or 4:1. Unless all of the planers in the department have the same ratio of v to V it becomes necessary to take these factors into consideration separately for the different machines.

The Ordinary Formula

The formula ordinarily used for calculating the time required for planing is: $T = \frac{WL}{f} \times \left(\frac{v + V}{vV}\right)$, and this may be still further reduced to $T = \frac{WL}{f} \times C$ when $C = \left(\frac{v + V}{vV}\right)$.

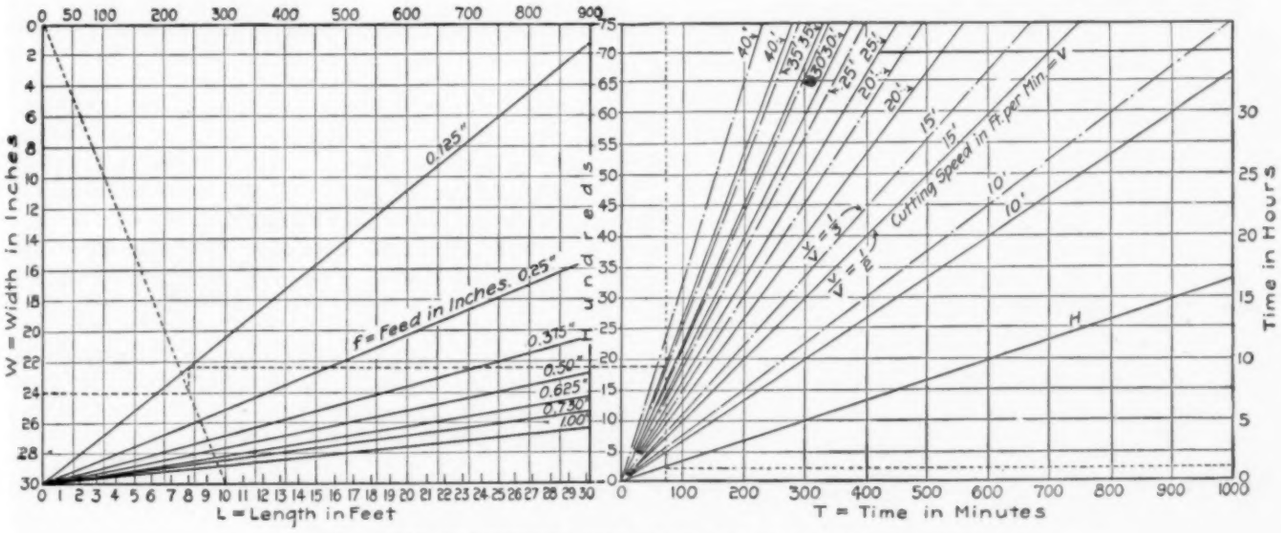
As an example let us assume, $W = 24$ in.; $L = 10$ ft.; $f = 0.125$ in.; $v = 40$ ft. per minute, and $V = 80$ ft. per minute. Then $T = \frac{24 \times 10}{0.125} \times \frac{40 + 80}{40 \times 80} = 1{,}920 \times 0.0375 = 72$ min., or $\frac{72}{60} = 1.2$ hr.

The same result can be obtained from the accompanying chart, as follows: With the straight-edge or celluloid triangle connect the length in feet, L, with zero at the upper left-hand corner; on the left scale find the width in inches, W, and read to the right until this line intersects the diagonal line formed by the straight-edge; thence along this vertical line until it intersects one of the diagonal lines representing the feed in inches, f; then, reading across to the right from this intersection, the result is found on the middle vertical scale. Continue from this value to the right until the line intersects one of the diagonal lines corresponding to the cutting speed in feet per minute, v, and thence to the scale at the bottom and read T, or time in minutes. If the time in hours is sought, follow the vertical line from time in minutes until it intersects the diagonal line marked H, and across from this intersection to the right-hand scale and there read T in hours and hundredths. (Follow broken line and arrowheads on chart.)

The diagonal lines in the right section of the chart represent the cutting speed for two ratios of v to V, namely, 1:2 and 1:3, the solid lines being the former and the dot and dash lines the latter. Other ratios could be added, but, for the sake of simplifying the chart here, only two are given.

Construction of the Chart

To construct the chart proceed as follows: On the left-hand margin, to any convenient scale, lay off the width in inches, or W. On the lower margin lay off the length in feet, using any convenient scale, and on the top margin place the results of $W \times L$, this scale will be governed by the size of the scales used for W and L.



A CHART FOR COMPUTING THE TIME REQUIRED FOR PLANING

It is not necessary to incorporate in the chart the vertical scale in the middle, but, if desired, it is determined by dividing the minimum and maximum results for WL by the minimum and maximum values for f, and a scale adopted that will keep these values within the confines of the chart. The diagonal lines for f may then be put in.

The next step is to plot the other half of the formula, or $\frac{v+V}{vV}$. It will be found more convenient to solve this, thereby obtaining the values for C, mentioned above. These values, or ratios, have been worked out and can be obtained from the accompanying table.

TABLE SHOWING THE VALUE OF C FOR VARIOUS RATIOS OF v TO V

v Ft.	*V Ft.	Ratio	C	Ratio	C	Ratio	C
10	20	1:2	0.150	1:3	0.133	1:4	0.125
20	40	1:2	0.075	1:3	0.066	1:4	0.0625
30	60	1:2	0.050	1:3	0.0445	1:4	0.0417
40	80	1:2	0.0375	1:3	0.0333	1:4	0.0313
50	100	1:2	0.030	1:3	0.0267	1:4	0.0250
60	120	1:2	0.025	1:3	0.0222	1:4	0.0208

* The values for V for the other ratios have not been given, and to obtain them it is only necessary to multiply v by 3, 4, or any number representing the proportion.

Then, to any scale, lay off horizontally the maximum number of minutes required, which is obtained by multiplying the values on the middle scale by C. The diagonal lines represent the values of C, and can be readily laid off by multiplying any value on the middle scale by any value of C, and then marking this value at the intersection of the horizontal line extending to the right of the value on the middle scale with the vertical line representing the time in minutes. Through this point of intersection, draw a line connecting zero and the top scale, as shown.

The scale at the extreme right is the time in hours, and is the quotient of the values on the bottom scale divided by 60 min. Determine the maximum time in hours and lay this off to any suitable scale, then plot the line H by locating the values of minutes divided by 60 at the intersection of the vertical and horizontal lines representing minutes and hours, respectively.

Comparison of Values

A little thought given to a comparison of the values of C will disclose the fact that with a ratio of 1:3, as compared with a ratio of 1:2, there is a decrease in the time of 11.3 per cent, and with a ratio of 1:4, as compared with 1:3, a decrease of 16.6 per cent is shown. Further comparisons show at just what ratio will the shortest time be obtained commensurate with other conditions.

Inertia and Initiative

By Entropy

Some twenty years or more ago Elbert Hubbard wrote the "Message to Garcia." There is no doubt but that it stirred many men to action for it was cleverly written and in a style that could hardly miss its mark no matter how little educated the reader might be.

Some one ought to write a "Message to Garcia" for the benefit of the employers of these many messengers. Some one ought to point out to them that just so far as they stifle initiative themselves they hinder not only their own progress but the progress of the Nation.

How many times men take new jobs with every intention and desire to make things hum, who strip for action only to find themselves facing stone walls of ancient and more or less honorable precedent. They find these stone walls back of hedges of attractive green shrubbery, but the shrubbery only conceals the walls and does not make them one whit easier to scale.

Our Inclination to Lag

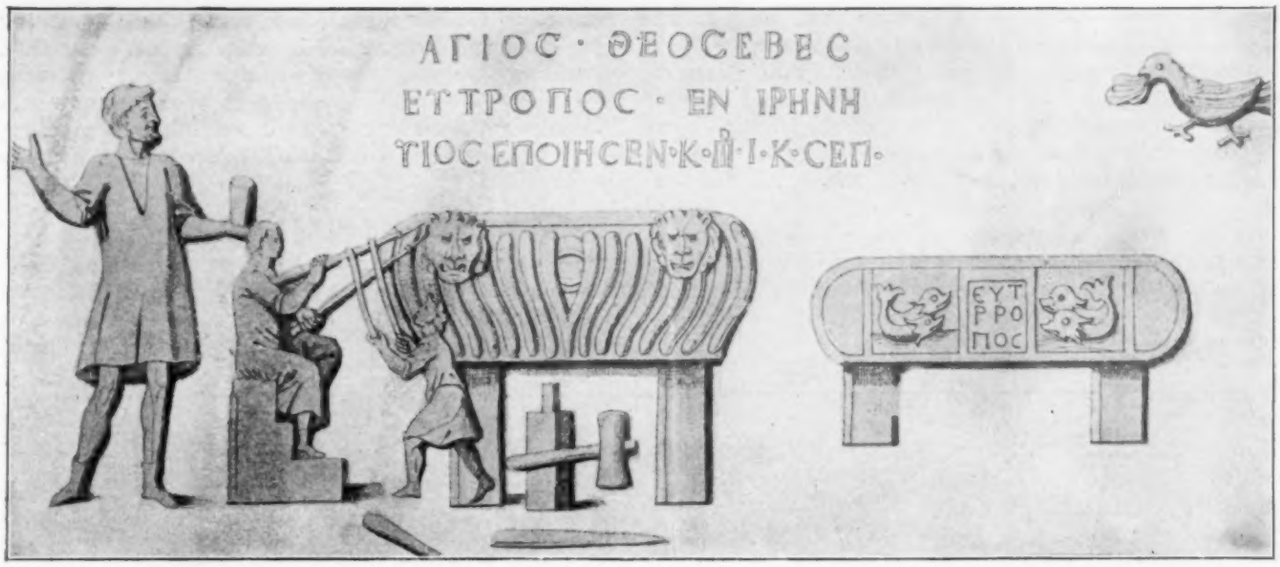
We are all more or less inclined to drag and lag behind. Inertia is a valuable force, but there is a tremendous waste in overcoming it when it gets in the way of progress. In things mechanical we are overcoming it. We knew a few years ago that mechanical flight was impossible. It was, until the traditions of a hundred years gave way and the internal combustion engine, which was only slightly antedated by the steam engine, awoke from its slumbers and developed into the low-weight power plant of today, and the art of flying became a possibility. The advent of the new alloy steels has made possible construction which was not even dreamed of a few years ago, and today the proposition to send a rocket to the moon does not appear at all a visionary thing, though in the time of Jules Verne it could be put over only as a story.

But with all this progress in material things our mental processes do not seem to advance. The philosophies of Socrates are accepted by about the same proportion of people as in his times. We seem to be able to change our environment but not ourselves. We cling to the "way we used to do it" with the greatest tenacity, so great in fact that the only progress possible seems to be made by those who rush in "where angels fear to tread." Pure ignorance seems to be the requisite for anyone who would advance our ways of business thinking, and that coupled with a hide so thick that no arrows of scorn and derision can penetrate.

The result is that we grow old before we are aged. Every avenue through which a man who is in the least degree sensitive can advance is closed, and he is kept in a low position until he is so thoroughly tamed that he is one of the regulars and can be depended upon to think in any given emergency as the founder of the firm thought a hundred years ago.

When Men Had to Find New Methods

There was a time, when the country was younger, when men had to find ways to do things for themselves rather than be taught the old way. That was in the time when men were subduing the fields of New England, and piling up stone walls separating the fields from each other, which now serve so useful a purpose for building roads. Then these men had to make shoes and they invented new ways to make them because they did not know the old ways. They invented the factory system because they did not have time enough each to learn to make a pair of shoes clear through. Today we have two quite distinct classes of manufacturing, the old established class which covers nearly all the necessities of life except a few that have just recently become classed as such, and the newer lines which have not as yet become standardized. We are apt to think of these latter in terms of crudity, and to hope for the time when they will also be standardized. Is there not something wrong with our rush for uniformity? Is not the handicap of increased difficulty of progress enough to more than overbalance the present cheapness of manufacture?



The Evolution of the Workshop—XIII

By H. H. MANCHESTER

The American metal-working industry in the period from 1840 to 1860 was characterized chiefly by the developments of quantity production and the system of interchangeable-parts manufacture. Inventions were many and far-reaching in scope and the growth of the industry was astounding, the progress made in the production of firearms furnishing a good criterion of this.

(Part XII appeared in last week's issue.)

AS IN the previous decades, the progress in metal-working machinery may be judged largely from the methods in use in making firearms, for in spite of the development of the steam engine and the railroad, munitions of war were still the metal productions which required the greatest exactness, and the field to which the greatest attention was given.

Firearms were becoming more and more interchangeable in their parts. The Jenks carbine and pistol, made by the Ames Manufacturing Co., was so exactly constructed that ten guns could be stripped at any time and reassembled indiscriminately. This was attained, however, principally by jigs and a fine set of gages. In the same year the new percussion musket manufactured at the Springfield armory was also made with interchangeable parts.

In 1846 de-carbonized steel was put into use by the Remington's. In the same year at that factory Albert Eames was using a strap drop for die forging. A compound-crank drop was employed by E. K. Root in 1850. The illustration, Fig. 83, shows a high frame with four pillars, at the top of which were the driving shaft and crank. Each machine had four drops.

A profiling machine for straight edging, shown in Fig. 84, was designed by F. W. Howe, and made use of by Robbins & Lawrence at Windsor, Vermont, in 1848. This machine seems to have been first used in the Springfield armory the next year, as there is an entry in the account book there at that date for work on such a machine. Two years later edging machines were in use in Sharp's Rifle Works at Hartford.

In 1850 a four-spindled vertical machine for boring rifle barrels was introduced by F. W. Howe at Windsor.

The manufacture of the early locomotives was accomplished only with the greatest difficulty. The plane work at first had to be done by chipping and filing, hand planing and slabbing. The earliest power planer built

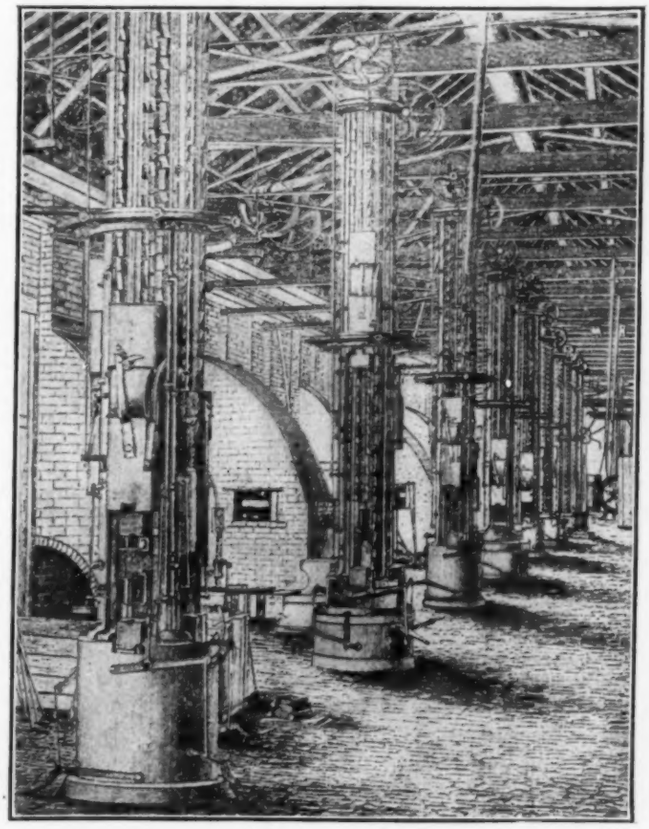


FIG. 83 COMPOUND-CRANK DROP-FORGING MACHINES OF 1850

in the United States seems to have been in the fall of 1839 at Chelmsford, Massachusetts, where in 1880 it was still doing good service in the shops of Silver & Gay. When built this was properly considered a wonderful mechanism, planing 22 ft. long, 3½ ft. wide, and 3½ ft. high. It was used for some years in making machinery for the Concord railroad shops, and for the shops of the Erie railroad at Dunkirk.

In locomotive manufacture we find a power press for wheels at Windsor in 1848, as well as large horizontal lathes for boring car plates. Vertical turning and boring machines for locomotives were employed at least as early as 1850.

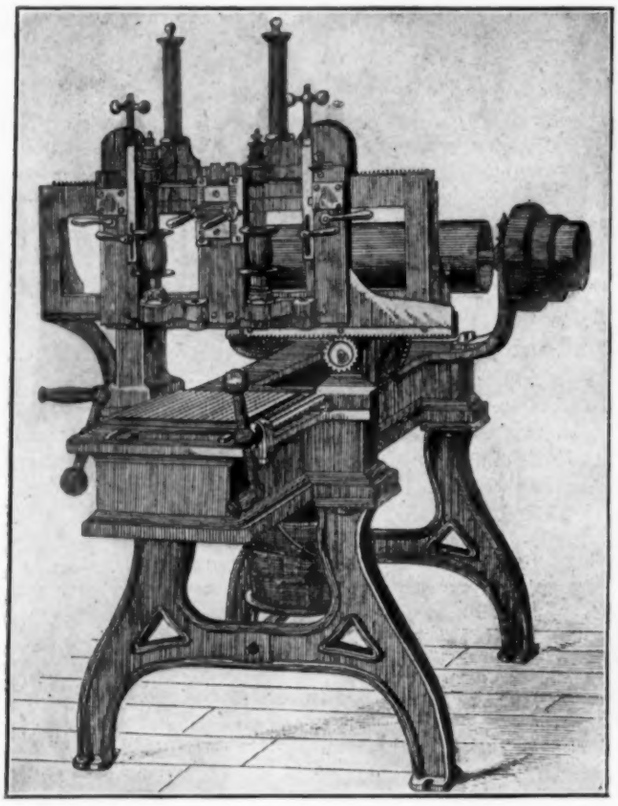


FIG. 84. T. W. HOWE'S STRAIGHT-SLIDE EDGING OR PROFILING MACHINE, 1848

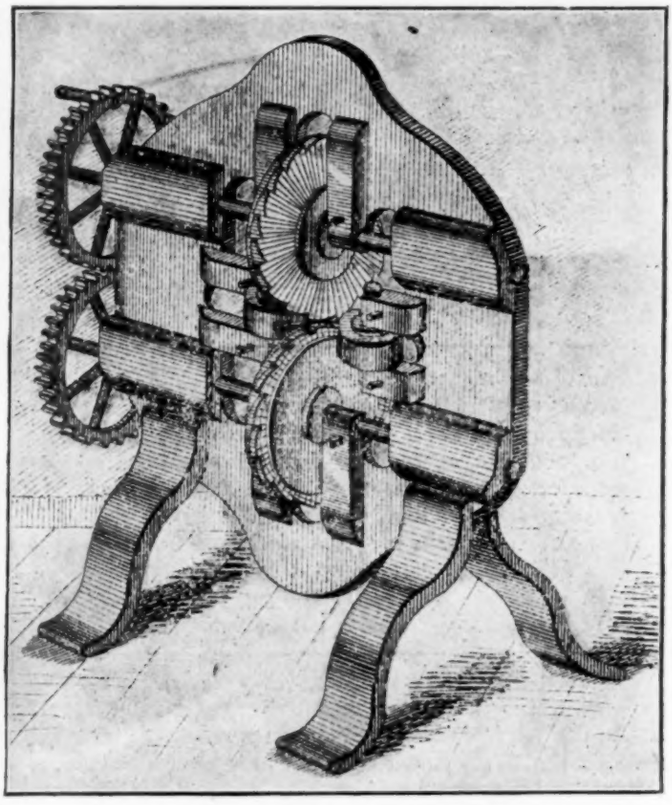


FIG. 86. A WIRE-NAIL MACHINE OF 1848

The first rolling of heavy iron rails of the T shape took place in 1844. A machine for making railroad spikes was patented by J. H. Swett in 1851, and one for heading bolts by Nathan Stark in the same year.

Patents of the Forties

Some conception of the demands and ideas of the time may be gathered from the more important patents.

In 1840 William Field took out a patent for screw augers. The same year a saw-filing machine was invented by E. Carver. In 1841 J. J. Howe patented a machine for making pins, while J. F. Wells patented one for dovetailing and tenoning. The next year W. F. Steiger received a patent for fluted nails and bolts.

In 1843 a machine for making horseshoes and another for links of chains were patented by J. F. Winslowe and Thomas Osgood, while Henry Burden took out an improvement on his horseshoe machine. The steam-driven forging machine, shown in Fig. 85, was developed at about this time.

In 1845 we find a self-adjusting screw finisher invented by Cullen Whipple, and a machine for making forks patented by S. H. Gilman. In 1847 a method of welding cast- and malleable-iron or steel was patented by William Marten, and the next year Vaughn and Winslowe patented a process for welding iron pipe. A new type of wire-nail machine, shown in Fig. 86, was also brought out.

Census of Occupations

Most interesting data connected with machine shops included in the census of 1850 is embraced in the tables giving the number of persons engaged in different occupations. According to these there were then not quite a hundred thousand blacksmiths and "whitesmiths" in the country. There were 24,000 machinists of which Massachusetts had 5,245 and New York 5,163. The millwrights numbered 9,613, and the general iron workers about 5,000.

There were said to be 3,843 gunsmiths, while the turners numbered only twenty less. As we have noted previously, the nail makers were comparatively numerous, though of course only a few when contrasted with their numbers today. There were said to be 2,046 in this trade. The toolmakers were enumerated as 1,191.

The occupations including between five hundred and one thousand workers were the cutlers, hardware makers, and saw makers. Those having between one hundred and five hundred were the armorers, wire workers, razor makers, file cutters, scale makers, wire makers, and screw makers. Those trades with not even one hundred, which were still considered important enough to list, were the safe makers, steel manufacturers, lathe makers, screw makers, pin makers, and needle makers.

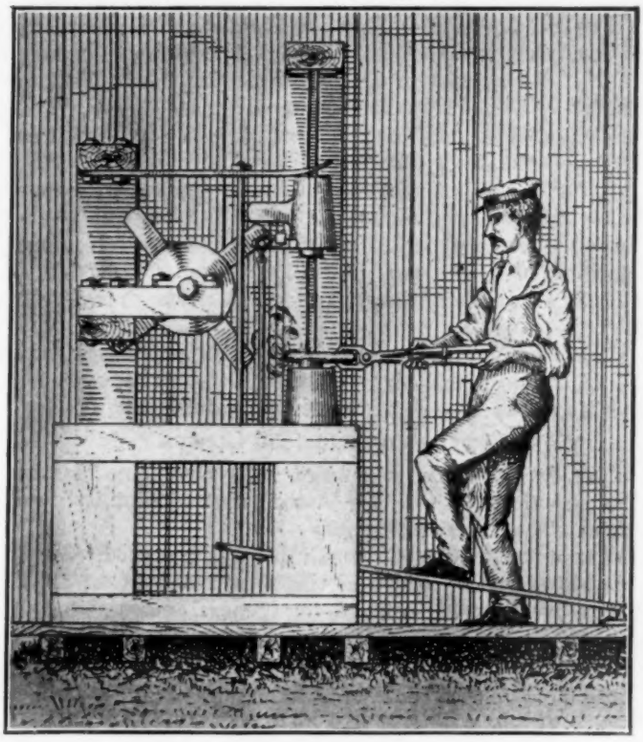


FIG. 85. A STEAM-DRIVEN FORGING MACHINE OF 1843

A general impression of the manufacturers of the United States at about that time is contained in a report of a British commission which inspected many of the shops in this country after the exposition of 1851. The report is by Whitworth and Wallace and was published in abstract in 1854. Whitworth paid particular attention to machinery, while Wallace devoted his investigations to other fields. What struck Whitworth particularly was the attempt to make machines as automatic as possible. As striking examples he mentions a machine for making ladies' hair pins used by Blake & Johnson at Waterbury, Conn., and one for shanking buttons which was set up in the same town in the plant of Benedict & Burnham. In the latter plant brass kettles and pans were not cast, but spun by being revolved under pressure until they assumed almost any desired shape.

In Pittsburgh Whitworth was interested in a machine for making railroad spikes. These weighed 1½ lb. each, and were turned out at the rate of fifty per minute. He said that seven men could make five tons of spikes a day. He found many self-acting machines for cutting nails in another establishment at Pittsburgh, and practical automatic machines which made rivets, weighing seven to a pound, at the rate of eighty a minute. In another place he found hook-and-eye machines making a hundred a minute. In Connecticut several plants were stamping out the works for brass clocks.

In general he says, however, that there was little cast steel made, and that the engine tools were lighter and less accurate than in England. The proportion of slide to hand rests on lathes in the United States was greater than in England. Planing and drilling machines for iron were common, but there were few horizontal or vertical shaping machines.

Whitworth enumerated in detail the seventeen processes used in the Springfield armory in the making of gun stocks. All were carried out by machinery which was based on the use of a forming or shaping machine that was developed from the principle of Blanchard's lathe. With the aid of these machines it then took slightly over twenty-two minutes to make a gun stock.

Developments in the Fifties

The decade preceding 1860 contained some developments presaging the present-day machine shop. Fig. 87 shows a machine for nicking screw heads. In 1852 we hear of a universal milling machine put into operation by Frederick W. Howe, and a lathe with a double turret set up by E. K. Root at Colt's armory.

The next year a rifling machine cutting three grooves simultaneously was designed at the Frankford arsenal in Philadelphia, and the next year a somewhat similar one was put in use by H. D. Stone at Windsor, Vermont. The latter was afterwards employed for the Springfield rifle. The interchangeability of American firearms had created a great impression abroad, and in 1855 Great Britain was supplied with 20,000 Enfield rifles which had this characteristic. The American universal milling machines were sold abroad at $850 each, and many orders were also placed for the Blanchard stock machine.

In 1854 we find Robbins and Lawrence building for sale the so-called automatic turret lathes. This was another very important step toward quantity production, which was becoming the distinguishing characteristic of the American factory.

In 1855 we hear of milling machines being made by George S. Lincoln & Co., of Hartford. In 1858 H. D. Stone designed a turret screw-making machine which was constructed by James & Lamson of Windsor, Vermont. Barrel rolling was introduced into the Springfield armory by J. T. Ames in 1860.

Patents of the Fifties

The patents of the 50's also indicate an increase in the interest taken in metal-working machinery.

In 1852 we find patents for screw threading by Cullen Whipple. The lathe for turning polygonal forms, shown in Fig. 88, is traced to this same period. The next year a patent for chain making without welding

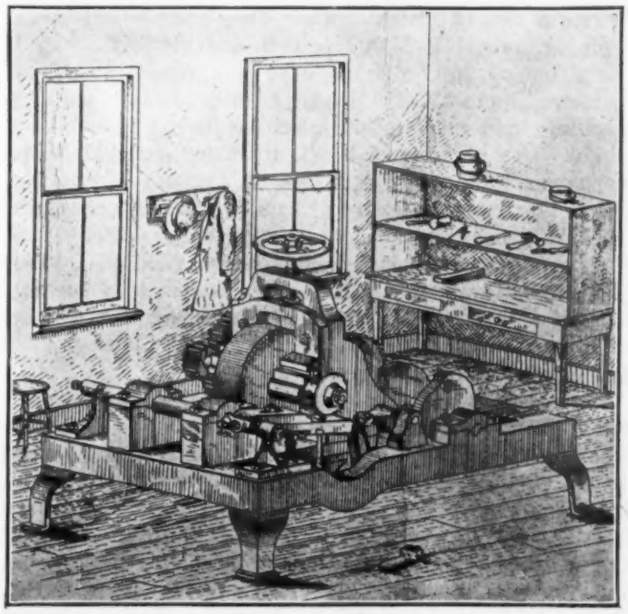


FIG. 87. A MACHINE FOR NICKING SCREW HEADS, 1850

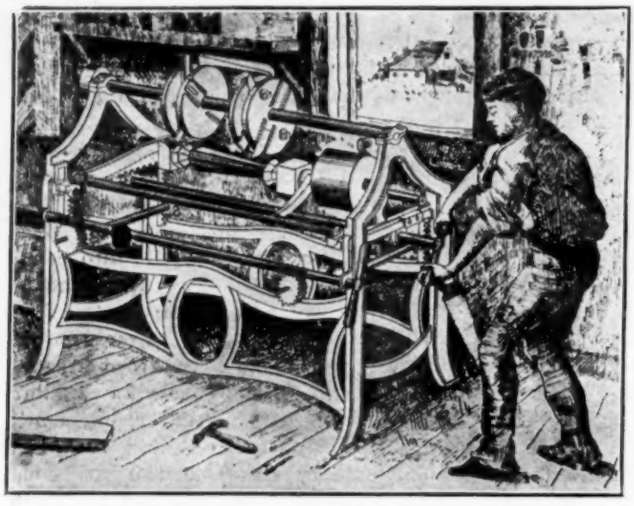


FIG. 88. TURNING POLYGONAL FORMS, 1852

was taken out by Christian Sleppy, one for a nut-making machine by Carter and Reese, and for a punching machine by Davie and Stephens. In 1854 a lathe for interiors was invented by Teale & Tyler, and J. A. Roebling patented his method of making wire rope.

A patent for a dove-tailing machine was given to T. H. Hurley in 1855, and one for a rifling machine to E. K. Root. The next year a machine for forging thimbles was patented by Corliss & Harris, and a machine for making brass kettles by Blakesley, Platt & Jordan. Fig. 89 shows a hub-mortising machine patented in the same year. Isaac Lindsley invented a method of carving wood in 1857, and a still more automatic lathe was patented by John McNary in 1858. The following year we find S. P. Ruggles improving the punch and stamp press, and the next year Milo and Charles Peck improving the drop press.

Shops of the Period

A work by E. T. Freedley, published in 1856, purported to give brief accounts of the leading machine shops of that date. According to this, the shop then equipped to build the heaviest machinery was I. P. Morris & Co., of Philadelphia. They were said to have a planer weighing 75,000 pounds and planing 32 by 8 ft., a boring mill able to bore a cylinder 16 ft. in diameter and 17 ft. long, besides heavy slotting machines and many other machine tools of their own make. The plant next best suited for general heavy work was that of Betts, Pusey & Co. of Wilmington, Del., who made a specialty of iron steamers and engines.

There were seven concerns producing chiefly stationary steam engines. Among these William Burdon of Brooklyn was mentioned as remarkable in making fifty of one pattern at a time. Two other very important ones were Thurston, Gardner & Co., and Corliss & Nightingale of Providence.

Four plants were said to be principally concerned with marine engines, of which the two chief were Reaney, Neafie & Co., Philadelphia, and the Shepard Iron Works of Buffalo. Locomotives were made by as many as twelve concerns, which indicates that there had been no more consolidation among these than among the railroads themselves. The chief plant of this sort in Pennsylvania was that of M. W. Baldwin & Co., Philadelphia, and the principal one in New York was the Schenectady Locomotive Works.

The chief plants making machinists' tools, according to Freedley, were Gage, Warner & Whitney, Nashua, N. H., which had been longest in the business, William Sellers & Co., Philadelphia, the Meriden Machine Co., in Connecticut, and Thayer, Houghton & Co., as well as Wood, Light & Co., in Worcester.

J. A. Roebling of Trenton had been making wire rope since 1842, and the New York Wire Rail Co. was weaving wire into gratings and fences. The first iron frame building had been put up by Bogardus of New York, and J. L. Jackson was specializing in structural iron there.

The stamping of brass works, which was well established in clock making, was just being introduced for producing works in quantities for watches.

Details of the 1860 Census

The details of the census of 1860 give some idea of the growth at that date. In each case a plant is listed under its principal product.

There was $1,778,000 worth of steel produced. Small as this seems, it was ten times as much as in 1850. There were 1,173 shops doing general machinist and millwright work, having a total value of $46,644,000. There were 443 shops producing general hardware, with a value of $6,700,000; firearms were manufactured in 239 shops to a value of $2,342,000; axes and edged tools were made in 166 shops, with an estimated product of $3,244,000; and there were 99 shops which made $9,857,000 worth of nails and spikes.

The development of railroad equipment shops may be judged from the fact that there were nineteen plants making locomotives to the number of 470, and with a value of $4,867,000.

Sewing machines, which were a comparatively new article of manufacture, were produced in seventy-four shops whose output was estimated at $4,248,000. There were fifty-eight factories constructing threshers and separators, and forty for reapers and mowers, all of which were just coming into extensive use.

There were seventeen plants for the manufacture of car wheels, forty for springs, and fifty-four for nuts and bolts, the total product in each line amounting to a little over $2,000,000.

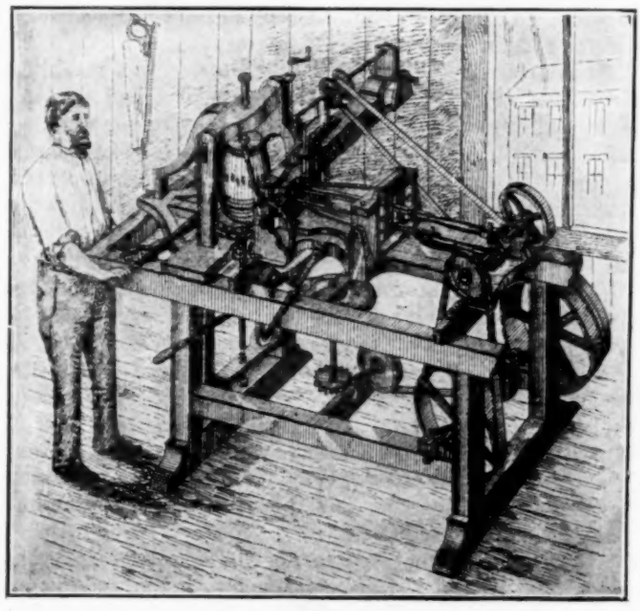


FIG. 89. A HUB-MORTISING MACHINE, 1856

Industries with an output of from one to two million dollars were iron forging with fifty-six shops, cutlery with fifty-one, saws with forty-two, and scales and balances with forty-three plants.

Industries with a production of less than a million dollars were malleable iron castings made in twenty-six shops; carpenters' tools made in thirty-three shops; and machinists' tools made in seventeen shops, one of which in Philadelphia produced almost half the total output. The industries of less importance than those mentioned were too many to permit of their treatment, but the census showed that great development was going on in all lines of metal working.

Crankcase Boring Fixture with Adjustable Supports

BY I. B. RICH

The supports *J* with the jaws *F* have to be removed while the crank case is being placed in position, and is then replaced and the lower supports brought up into contact with the boring bars while the work is being done.

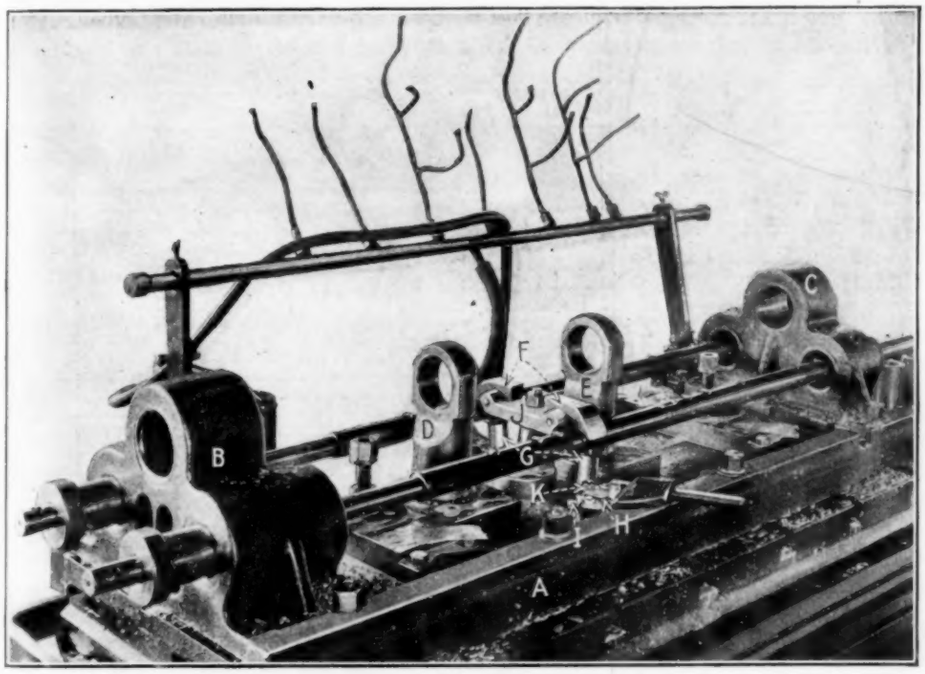


FIG. 1. BORING FIXTURE FOR CRANKCASES

It will be noted that careful provision is made for lubricating the various cutters by means of the piping shown at the back of the fixture in Fig. 1. These are now turned up out of the way in order to allow a crank case to be easily put in position. Each pipe is provided with the correct number of outlets to lubricate each cutting point, and an ample supply of lubricant is provided by the holes and the large pipe which forms the support. The two camshaft boring bars are simply shown in position to illustrate the way in which they are supported, it being, of course, necessary to remove them before putting the crankcase into position.

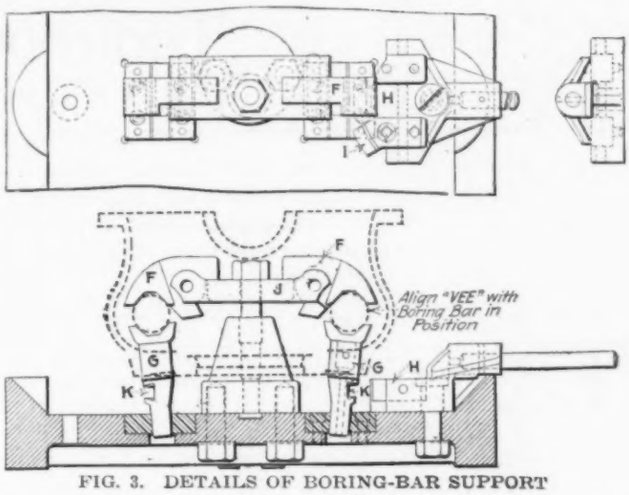


FIG. 3. DETAILS OF BORING-BAR SUPPORT

The illustrations show a very substantial fixture used by the Pierce-Arrow Motor Car Co. in boring its six-cylinder crankcase. This consists primarily of the bed *A* and the two heads *B* and *C* with the supports *D* and *E* for the main boring bar. Figs. 1, 2 and 3 have corresponding letters, so that the details will be easily distinguished. This fixture bores for the main bearings and also both camshaft holes, the motor being of the T-head type. Substantial bushings are provided, as can be seen.

One of the interesting features of this boring fixture is the central support for the two camshaft bars at *F*. Fig. 3 shows the details of this support, which consists of the crossbar *J* carrying the arms *F*, while the lower support *G* is located and held in position by the swinging locks *H* carrying the projections *I* which fit into the opening *K* and hold the lower supports firmly in position during the boring operation. These precautions against springing greatly reduce the time required in assembling the parts.

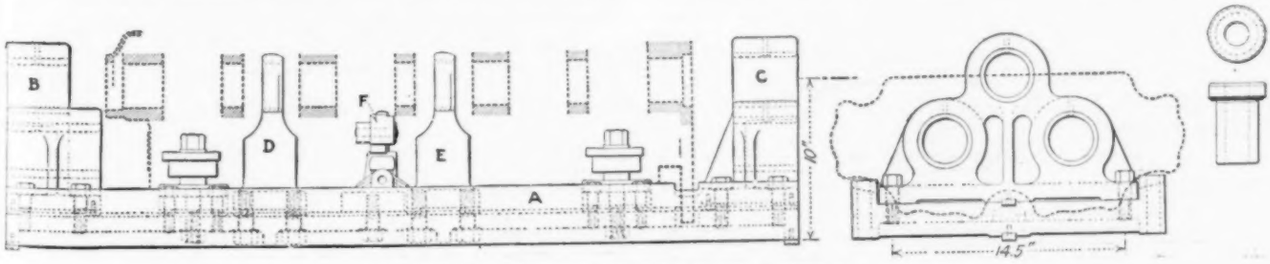


FIG. 2. GENERAL DETAILS OF FIXTURE

Toolroom System

By E. E. HIRSCHHAUTER

The system described in the following article has been in successful use for the last five years in one of the biggest gas-engine shops in the country. It may help others who are organizing or re-organizing toolroom systems.

THE engineering department, when completing the design for a new type of engine, notifies the planning department, which in turn gives the tool division a complete set of blueprints, fixes the date the tools should be ready for production and makes out the orders for purchased material.

The head of the tool division goes over the blueprints and makes sketches of the tools required, which he submits to the conference for discussion. If acceptable he then has individual tool orders made out for every tool required, on the form shown in Fig. 1, giving the number of pieces per month, saving estimated, and the cost of the new tool. The order is now sent to the general superintendent and general manager for approval and then forwarded to the cost department, where an expense number is assigned and entered on the form shown in Fig. 2. From here the order is sent back to the tool division which now has the authority to proceed with the work.

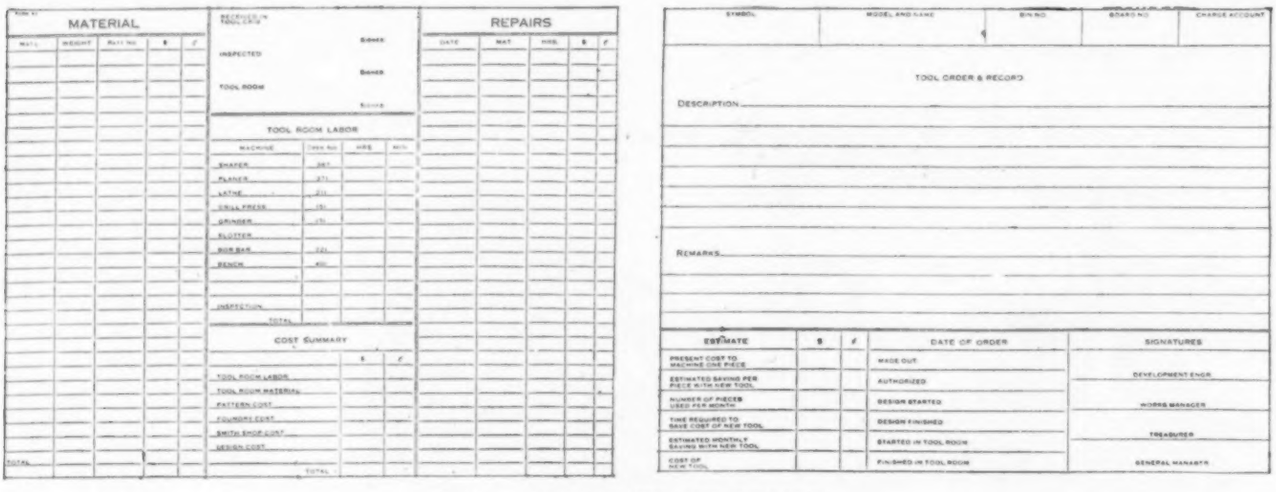


FIG. 1. TOOL ORDER AND RECORD

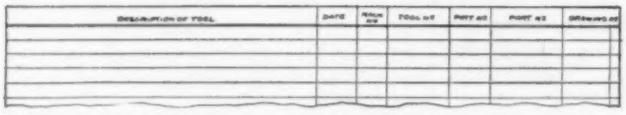


FIG. 3. RECORD OF DRAWINGS, PART NUMBERS AND SYMBOLS

On the drawings there is a stock list giving the *finished* over-all dimensions of the various pieces to be machined, thus making it easy to order stock from this list.

Fig. 3 is the record card used for recording drawings and part numbers or symbols. Only two records are kept, one for the drawing number and one for the part number. The tool number and pattern number correspond with the drawing number. Should it be required to have more than one tool or pattern number on one drawing, as many dash numbers as required can be attached to the original number. For instance, if the drawing number is 2531 and there are three tool numbers, they will then be 2531-1-2-3. There is only one form used for both records. If used as a drawing-number record, there is placed an x on top of drawing number in the right-hand corner, and the card is filed in the drawing-number file. If used, a part-number record, an x, is placed over part number and filed in the respective file. The same form is also

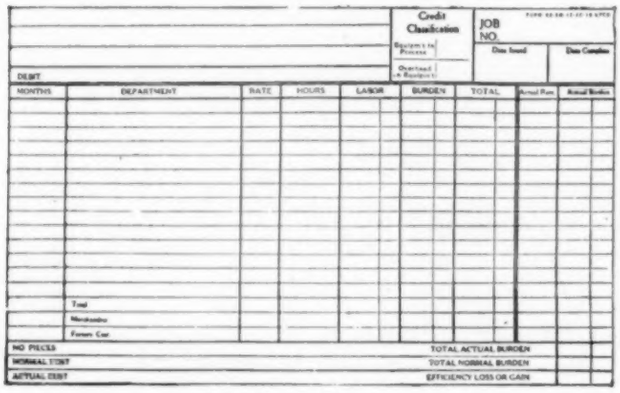


FIG. 2. COST CARD

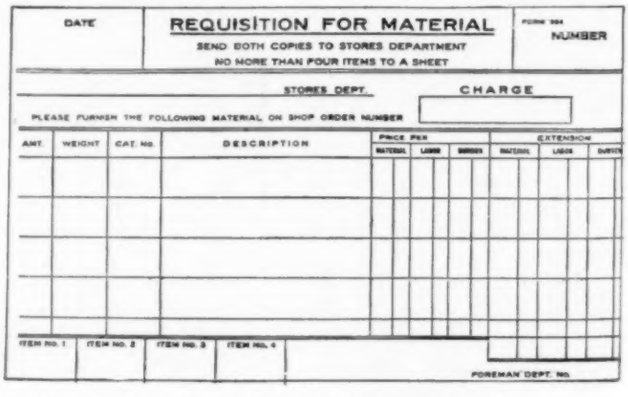


FIG. 4. MATERIAL REQUISITION

Board No.	Symbol	Bin No.
Description of Tool		Order No.

No. Pcs.	Mat.	Size or Patt. No.	Date Received

	OUT / IN	Clock No.	Oper. No.
	OUT / IN		
	OUT / IN		
	OUT / IN		
	OUT / IN		
	OUT / IN		
	OUT / IN		
	OUT / IN		
	OUT / IN		
	OUT / IN		
	OUT / IN		
	OUT / IN		

FIG. 5. THE BIN TICKET AND TIME CARD

used for recording drawings and sketches pertaining to machine repairs by simply placing an x over machine number and filing away in the machine repair file.

Requisitions Made Out from Blueprints

When the drawing is completed, blueprints are made, and the tool-division clerk proceeds to make out material requisitions in duplicate on the form shown in Fig. 4. Small screws, cotter pins, etc., are not ordered here, as it has been found more expedient to have a small stock in the toolroom crib from which the men can draw. If a pattern or forging has to be made, a blueprint attached to a departmental order is sent to the pattern or forge shop.

For making out the board and bin tickets, the form shown in Fig. 5 is used. This ticket has a board number with a letter prefixed for each department. The bin number corresponds to an empty bin in the toolroom racks, Fig. 6, and to enable the tool-design clerk to keep track of the empty bins, he is provided with a board that has as many holes as there are bins in the toolroom rack. When he assigns a bin to a certain job, he places a wooden plug in the desired hole in the board and puts that number on form, Fig. 5.

The tool order with all blueprints, material, requisitions, etc., is then sent to the toolroom foreman, who first of all looks over the material requisitions to find out if any scrap material on hand could be used. If there is none available, he sends these requisitions to the store, retaining a copy for checking purposes. Board ticket, Fig. 5, is placed on the control board and the order is attached to the proper bin. The blueprints are also placed in the bin.

First Operations After Delivery

As fast as the material is delivered it is placed in the bin and checked off on the bin ticket; thus the foreman can at any time see what has been delivered and what is still due.

When all the material has been received the job is ready to get started. Should turning be the first operation, all the pieces to be turned accompanied with the blueprint will be handed to a lathe hand who has to go to the toolroom clock and ring in on the back of board ticket, Fig. 5. On completion of this operation the man rings out and hands the pieces to the foreman, who, after a quick inspection, sends them back to the bin. This prevents the material from getting lost or misused. Of course, sometimes it will be necessary to have more than one man working on the same job, and in that case as many board tickets as required can be added to the first one.

After the tool is completed and inspected, a delivery slip with two copies is made, the original is retained in the toolroom for reference, one copy accompanies the tool to the tool crib, and one is sent to the efficiency department. The tool order is also taken along and the receipt of the tool is signed for on the back by the tool-crib tender and superintendent.

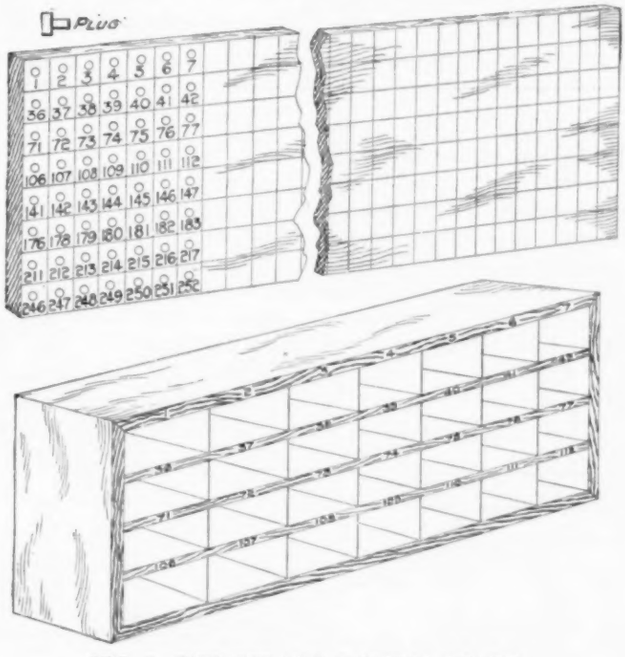


FIG. 6. THE BIN AND CONTROL BOARD

MOTOR NO	REPAIR ORDER	MACHINE NO
DEPT.		DATE
MACHINE REPAIR	MOTOR REPAIR	BELT REPAIR / TOOL REPAIR
REPAIR PARTS AS DESCRIBED BELOW AND CHARGE TIME AND MATERIAL TO		

FIG. 7. REPAIR ORDER

Form 37, SM 1-20 SPCO.

MACH. NO._____

PLANNING DEPT.

Monthly Machine Lost Hour and Cost Record.

	LOST HOURS						REPAIR COST			
DATE	MACH. BELT REP.	MOTOR REP.	TOOL REP.	OPER.	PROD.	TOTAL HRS.	MACH. BELT REP.	MOTOR REP.	TOTAL REPAIR COST	TOTAL COST
1										
2										
3										
4										
5										
6										
7										
8										
9										
10										
11										
12										
13										
14										
15										
16										
17										
18										
19										
20										
21										
22										
23										
24										
25										
26										
27										
28										
29										
30										
31										
TOTAL										

VALUE PER HOUR_____

FIG. 8. MACHINE-REPAIR CARD

The tool order and board and bin tickets are then returned to the tool-design clerk, who figures up the time and cost of material, forgings and patterns and enters these items on the back of the order form, Fig. 1. He also pulls the plug from the board, Fig. 6, thereby releasing this bin and putting it at the disposal of new work. The tool order is then filed in the permanent file in the tool-design department.

For repairs the form, Fig. 7, is used. On receipt of a tool repair the toolroom clerk makes out form, Fig. 5, for the control board, stamps a number on this ticket and on the repair order and sends the copy back to the issuing foreman, who, through this number, can at any time inquire about the progress of the repair.

The tool to be repaired together with the order is then placed in the bins reserved for repairs and all necessary material ordered. The number stamped on the order is also put on the material requisitions in order to keep the material from getting mixed up.

Every day the finished repair orders are sent to the planning department where the tool repairs are posted on the back of form, Fig. 1, and the machine repairs posted on form, Fig. 8. From this form, at the end of the year, the totals are transferred to form, Fig. 9.

REPAIRS AND LOST HOURS

YEAR	MACH. & BELT REPAIR			MOTOR REPAIR			TOOL REPAIR		OPERATOR		PRODUCTION				
1920															
1921															
1922															
1923															
1924															
TOTAL															
1925															
1926															
1927															
1928															
1929															
TOTAL															
1930															
1931															
1932															
1933															
1934															
TOTAL															
GRAND TOTAL															

FIG. 9. ANNUAL REPAIR COSTS

Looking Backward

BY HARRY B. STILLMAN

Some of these older shop men who sigh for the good old days will grant that the present-day method of providing drinking water for the employees has something on the old-time unsanitary method of years ago. They will agree that the modern bubbler, or the sanitary cup, is miles ahead of the old water pail and its boon companions the rusty dipper and the unclean glass. The unwholesome practice of using a common drinking vessel and the consequent risk of contagion was quite usual in most shops twenty-five or thirty years ago.

Every plant under modern management has its own method of serving drinking water to the workers, either by means mentioned above or by some other custom that at least carries out the principles of sanitation. Every employee who punches a time clock where I am employed enjoys the privilege of drinking good cold water, as near pure as well water could reasonably be expected to be, that is pumped from a number of artesian wells located where danger from pollution is very slight. To guard against contamination the company keeps a watchful eye on the purity of the water by having it analyzed every so often, and the result of the test is posted on the bulletin board so that the employees can read and satisfy themselves on that score.

While we are on the subject of water I would like to call the attention of those old timers to the many improvements that have taken place the last twenty-five years in the means provided for the shop-worker to wash up. Take for example the modern shop sink, large enough to accommodate a dozen men on a side with an adequate supply of hot and cold water always on tap, where the washer can splash around at his heart's content. Compare it with the old-style wash-bucket that was usually to be found in the shops of the smaller towns years ago. Or compare the wash-rooms and lavatories found in some of the progressive plants of today with the dinky little two-man sink that stood service in the old days for a room full of employees.

I recollect a job of filing castings which fell to me nearly twenty-five years ago, and how I used to slink down in the seat of the street car on my way home from work, hoping that none of my acquaintances would board the car and see me with my face and hands smudged with the grime of cast iron. There was only one small sink in the shop for about thirty men, and were I to wait my turn it would have meant the loss of my car. Nowadays a man can be covered with grease and grime at quitting time and yet leave the factory all spick-and-span with a bath, hair combed, a shine, clothes brushed and everything but having his nails manicured. Perhaps we'll get that later.

Making a Pressed-Steel Base for an Electric Fan

By H. JAY
Sales Manager, The Acklin Stamping Co., Toledo, Ohio

This article tells of a stamping process for producing the base of an electric fan, the method being different from that usually employed for making such parts. The sequence of the operations and the tools used are shown in the accompanying drawings.

THE manufacture of a pressed-steel electric-fan base presents a problem that not only is interesting from the viewpoint of stamping but also offers a very good example of the economy of substituting this method of production for the casting or spun form. In this particular instance, where the base itself is given a high-class enamel finish, there is a considerable saving in grinding and buffing the piece before the enamel is applied. Furthermore, the weight of the finished stamping is less than that of a corresponding casting, and the method of cutting slots and holes is cheaper than if a milling machine and drill press were used.

The accompanying sketches show the general types of tools used in making the various reductions, as well as the dimensions of the part produced by each tool. The material specification calls for cold-rolled deep-drawing strip steel of 0.095 per cent carbon. Steel of this grade properly worked produces a stamping with a surface which can be enamelled with very little buffing.

The first operation is that of cutting the blank, which

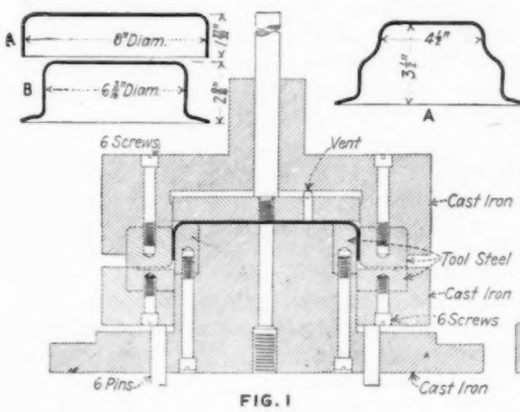


FIG. 1

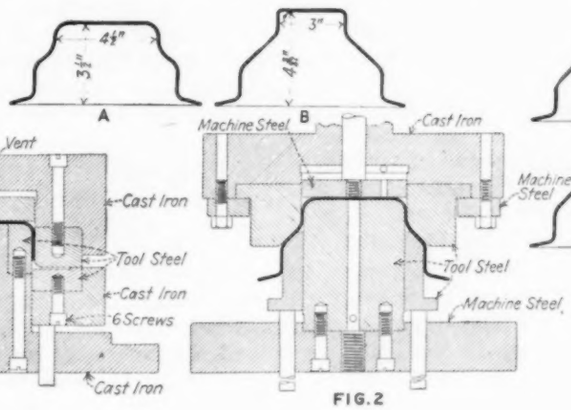


FIG. 2

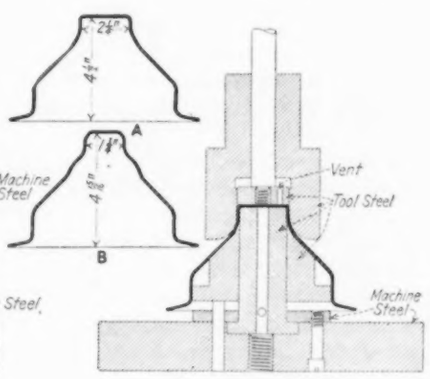


FIG. 3

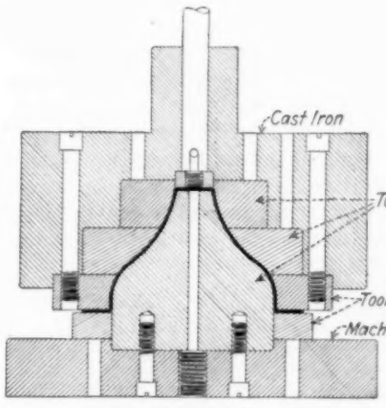


FIG. 4

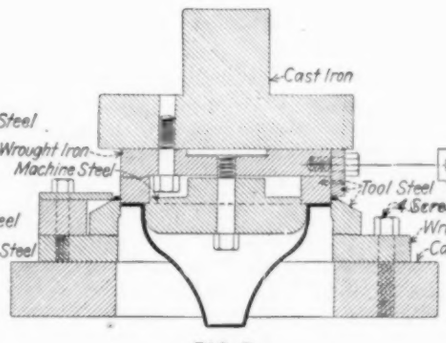


FIG. 5

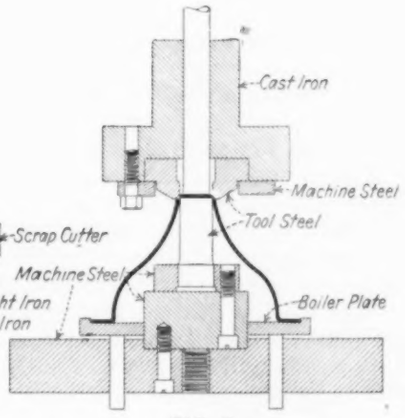


FIG. 6

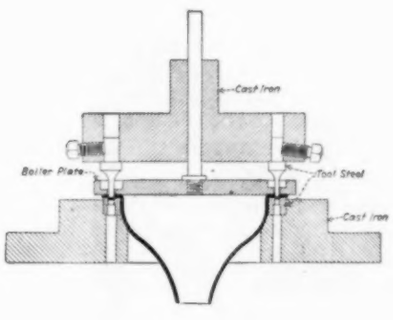


FIG. 7

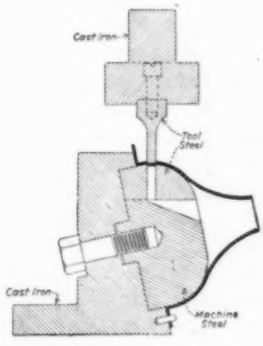


FIG. 8

FIGS. 1 TO 8. SEQUENCE OF OPERATIONS FOLLOWED IN MAKING THE PRESSED-STEEL BASE FOR AN ELECTRIC FAN, SHOWING THE TOOLS USED

Fig. 1—The first drawing operation. Fig. 2—The third drawing operation. Fig. 3—The fifth shaping operation. Fig. 4—The final forming operation. Fig. 5—Trimming the edge of the flange. Fig. 6—Punching the hole in the nose. Fig. 7—Punching the holes in the flange. Fig. 8—Punching the slot on a horn die.

FIG. 9. THE FINISHED BASE

in this case is 10½ in. in diameter. A standard type of blanking tool is suitable for the work, one being used in which the punch and die are each made up of composite forgings of wrought iron and tool steel, which forms the cutting edge.

The first draw is made in the second operation with a drawing die, as shown in Fig. 1. All parts of the die are constructed of cast iron faced with tool steel. A single-action press is used, and the die operates quite similarly to the ordinary spring drawing die. The pressure necessary for holding the blank is applied to the draw ring by the six pins shown which rest upon the upper of two plates, which are not shown in the illustration, and between which the rubbers are held. As the punch descends, the edge of the blank is held with a pressure which increases as the rubbers are compressed, and there is no chance for the edge of the work to wrinkle, even as the drawing becomes harder and deeper.

The knockout pad, shown resting on the work on top of the plug forming the die, serves to release the work from the punch in case it should stick when the punch ascends. In Fig. 1, *A* shows the part after the second operation; while in the third operation the piece is reduced still further with a tool which is similar in construction and operation to that first used, its shape being shown at *B*.

The reduction in the fourth operation, Fig. 2, starts the piece toward its final shape. It is important that the correct radii be selected for the punch and plug so that the proper reductions will follow. The die is similar to those previously used except for the tool-steel plug and draw ring and a machine-steel base. The draw ring is used to center up the work before the reduction starts. The next reduction is handled in much the same manner, the shape of the work being given at *B*, Fig. 2.

A further reduction is made in the sixth operation, Fig. 3. Here, again, care must be used in selecting the radius of the punch so that the stamping comes out with a nice flare. The nose of the piece is then reduced more like its final shape in the seventh operation, *B* in Fig. 3 showing the stamping after this stage.

If the various reductions have been properly made the stamping now takes it final shape in the next operation. The stamping die, Fig. 4, has a machine-steel base and a tool-steel draw ring with just enough motion to raise the stamping off the plug at the finish of the stroke. A plug to conform to the finished shape is made of tool steel and the punch is built up of tool-steel sections. This is a type of construction that was developed during the past war in work on shell casings for the Government. The hardening of a punch of this size in one piece invariably means that warping follows and the center portions do not always receive the proper treatment. If the sections of the built-up punch are hardened separately, these objections are entirely eliminated. The operation of the die reduces the stamping to its final finished shape and flattens out the flange on which the base rests. The regular form of knock-out is used in the punch.

After trimming the flange, the base is complete, except for the various piercings necessary to conform to the fan manufacturer's designs. For the trimming operation itself, the work is inverted, Fig. 5, and a drop-through type of die is used. Production is thus increased by permitting the stamping to drop through the bolster to a receptacle and by facilitating the removal of the trimmed scrap by cutting it with two wedge-shaped scrap cutters. The method of piercing the hole in the nose is shown in Fig. 6 and that used for the small holes in the base appears in Fig. 7, the construction being plainly shown.

For the slot and holes which provide for the switch lever and electrical cord, the piercings are performed on an ordinary type of horn die, Fig. 8, with a cast-iron holder, machine-steel horn and tool-steel die and punch.

THE FINISHED STAMPING

Fig. 9 is reproduced from an untouched photograph of the finished stamping. Examination will show that it is entirely free from reduction marks and that the gage of the metal is uniform. This is the result of careful consideration in selecting the radii of the various punches and dies for the drawing tools.

The tools and stamping described in this article were designed and produced in the shops of the Acklin Stamping Co., Toledo, Ohio, where considerable work of this nature has been done with a view toward speeding up production and reducing manufacturing costs. The advantages to be gained by using pressed-metal parts are becoming more evident, and this fan base is just one example of the many types of parts which can be produced by this speedy and economical method of manufacture.

Economy in Cutting Bar Stock

BY I. B. RICH

Having a large number of gears to be made from 4-in. bar stock, it was decided to cut off the blanks on a hacksawing machine. A careful analysis of the time taken, and the efficiency of the hacksaw blades resulted in some rather interesting data. It was found that while some blades would make as high as twenty cuts before becoming too dull for use, it was not found to be economical to use them for this length of time. Experiments were made, changing the blade after making eight cuts, and with other numbers up to twenty for the maximum life of the blade.

After considering the time required in making the cuts and the cost of new blades it was found to be most economical to change the blade after twelve cuts, and this is now the regular practice in the shop of the Johnson Gear Works, San Francisco, Cal. The tests were made by the superintendent, Walter I. Brown.

Make Employees Read the Plant Paper By Telling About Their Babies

By Frank H. Williams

PEOPLE are always interested in babies. Folks like to know about new babies in the families of their friends or in the families of their fellow workers. They like to know what these babies have been named, what they look like and everything else connected with them.

And right here is a hint for the editors of internal house organs or plant papers. Put a lot about the employees' babies into the publication if you want to make the employees read the paper.

This is one of the schemes used with great success by the editor of the *Bowser Booster*, published by S. F. Bowser & Co., of Fort Wayne, Ind., for its employees.

The Bowser plant employs about 1,500 men in its home plant. It manufactures gasolene tanks and pumps, and it is up against the usual sort of thing experienced by manufacturers who try to increase morale and interest among employees by the publication of a plant paper.

Every month—the *Bowser Booster* is issued once a month—the editor runs at least one page of pictures of employees' babies. If there are enough pictures two pages are run. The pictures used are not conventional gallery photographs, but the unconventional, natural pictures which fond parents or relatives snap when the baby is least aware of what is going on. Such pictures give a life and snap to the page which ordinary gallery photographs would never have. Under each photograph run some snappy sort of caption. For instance, under a photograph of a tiny tot who looked particularly pugnacious this caption was run: "Want A Fight?" Then followed the name of the infant and the names of his parents. Under a picture of a little boy all tightly bundled up for winter was run a caption which was particularly appropriate at the time the picture appeared. This caption was "All Ready for a Coal Strike." Following the caption, of course, came the name of the child and the names of the parents.

In addition to running pictures of the babies, the publication faithfully chronicles the arrival of infants in the families of its employees. This chronicle is made as readable and as interesting as possible. For instance here is the way a typical month's issue chronicled births.

"On the ninth of last month there arrived at the home of Mr. and Mrs. H. C. Slater, a daughter, Eilene May. Mr. Slater is one of the boosters in the sundries department.

"It is not at all surprising that Ned Witte, of the yard department, better known as 'The Flying Dutchman' should come to work with a big smile and a box of cigars. Who wouldn't if he were the proud daddy of a baby girl?

"Louis Krimmel, of the factory office force, gave off six feet of blushes and several kinds of stammers last week when he tried to explain to Joe Smith, of the stationery stock room that his requisition calling for '1 doz. Rubber Nipples' should have been for 'erasers' instead of nipples, but his confusion gave him away and he has to fess up to having become daddy to a nice baby on the twelfth of last month."

Recently S. F. Bowser, the president of the concern, started the Bowser Loan and Trust Co., for the convenience of employees and people of the neighborhood. The Bowser plant, it might be noted, is located in the southwestern part of the city, a considerable distance from the center of the town, and in a locality which is so much distinctly its own section that it has the name of Bowserville.

After the inauguration of this trust company the *Booster* announced that it would celebrate the advent of every baby in the family of an employee by starting a savings fund for the baby in the trust company. This announcement and the details concerning it were couched in the following words:

"When the new baby arrives, you have a sense of hilarity and joy, of course. But with it all is also a sense of great responsibility that rests upon dad's shoulders. The future is a great unknown, stretching away and away, far beyond the ken of any man.

"Men who are thoughtful on this subject become possessed of a strong desire to begin NOW, immediately, to provide in some way for the future of that baby boy, —that baby girl—and yet it does not readily appear just how the future of the child can be safeguarded.

"The *Booster* wants to help solve this problem, or at any rate, one phase of the problem, and the following standing offer is made:

1. For each birth reported promptly to the *Booster* by the father, an employee of S. F. Bowser & Co., Inc., Fort Wayne, Ind., five dollars will be deposited in the name of the child in the Bowser Loan & Trust Co.

2. When the child is one year old, the *Booster* will authorize the Bowser Loan and Trust Co. to add one dollar to the account, provided there has been deposited by the father during the year previous, *FIVE* dollars or more for the child and provided the bank book is presented at the bank for such addition upon the first birthday of the child or promptly thereafter.

3. When the child is two years old, the *Booster* will add two dollars to the account provided again that the father has placed another five dollars to the credit of that account during the second year of the child's life and provided again the bank book is presented at the bank on the birthday of the child or promptly thereafter.

4. Three dollars will be added on the third birthday, four dollars on the fourth and five dollars on the fifth, always provided at least five dollars has been added by the father during each one of the years, currently as passed over.

5. The *Booster* feels that, after the fifth birthday the father should continue his practice of adding to the child's saving fund—but the *Booster* will not make any further deposits for the child.

6. This further provision is made, however: The deposits made by the *Booster* and the required minimum yearly deposits of five dollars by the father may not be withdrawn until the child is six years old unless the father discontinues his employment with S. F. Bowser & Co., Inc. If the father does, after the first birthday of the child, discontinue his employment with the company, ALL the money may be withdrawn (in-

cluding the *Booster* deposits), or the father may continue the account in the Bowser Loan & Trust Co. It is to be understood, however, that the *Booster* will not continue its yearly additions to the account after the father has left the employ of the company. It is to be understood further that in case the father leaves the employment of the company before the first birthday of the child, the original *Booster* deposit of five dollars is forfeited and reverts to the *Booster*.

7. Four per cent interest will be paid on each account.

8. First notice of the child's birth must be sent to the *Booster* which will make the first deposit and send the bank book to the father. On the first birthday of the child and on each succeeding birthday, to and including the fifth, the father will not be required to do more than go to the bank to have the new *Booster* deposit entered in the bank book.

By this plan, it can be seen, the *Booster* during the course of five years deposits $20 to the child's credit provided the father during the same period deposits $25. Therefore at the fifth birthday there would be $45 on deposit to the credit of the child in addition to the accrued interest.

Pages for the Home

In addition to arousing interest among employees by this emphasis on babies, the *Booster* also increases interest in the homes of employees in the publication through the use of children's and home pages. On the children's page appear little puzzles to which answers are given the following month. And on the home page appear tested recipes which are sent in by wives of the employees.

To arouse the interest of the children, prize contests are frequently run for them. One of these recent contests was on the topic "What My Daddy Does at Bowser's." As prizes in this contest deposits of $3, $2 and $1 in the savings account department of the Bowser bank were offered for the three best letters. The prize winning letters were, of course, published in a subsequent issue of the *Booster*.

This emphasis on babies, children and the home in the *Bowser Booster* has the very desirable effect of making employees and the members of employees' families not only read the *Booster* but look for its appearance and welcome its advent enthusiastically. It gives a warm, intimate, personal touch to the publication and also arouses in the minds of the readers the idea that all Bowser employees are members of a big family.

Surely there is a hint in all this for editors of such internal house organs or shop papers which are not registering as emphatic hits with its employees as might be wished.

Why not take a leaf from the experience of this publication and run a page or two of baby pictures every now and then? There isn't a single father or married man in the plant who won't be interested in seeing pictures of other employees' babies. And, in the great majority of cases, the employees will not only be interested in the pictures themselves but will take the publication home to show to their wives and families. And when the employees get to the point of preserving the plant publication and showing it to members of their immediate family and to relatives and acquaintances, then the plant paper may be safely declared to be a success.

What Is a Machine Tool?

By Frank C. Hudson

It is one thing to have a fairly definite idea of what one means, either as to machine tools or anything else, but it is quite a different and much more difficult proposition to formulate a definition which will convey the same idea to others, and at the same time not be capable of construction into an entirely different meaning. The definition of machine tool has long bothered many of us who are engaged in this line, and it is quite probable that the definition given by A. L. De Leeuw on page 106 of the *American Machinist* for July 15, 1920 is as clear and as comprehensive as it is easy to formulate.

The one particular loophole which appears to me in this definition is the use of the words "removal" or "removing," either metal or other material. The punch press is unquestionably a machine tool although many have barred it from the list, but is it not equally a machine tool when it is used for drawing, bending or otherwise forming metal or other material, as when cutting with the aid of punches and dies?

I am well aware that widening the scope of the definition includes forging hammers (and forming machines) of all kinds. But, on the other hand, Mr. De Leeuw's definition admits shearing machinery, even billet shears, which the makers of precision lathes would object to having mentioned in the same breath with their own product.

My addition to Mr. De Leeuw's third definition would make it read: "A machine tool is a machine *capable* of removing metal from a piece or of otherwise changing its form, and containing means for holding, guiding and controlling the work, or tool, or both."

This definition could, of course, be stretched to include rolling mill machinery, but on the other hand, it seems necessary if we are to include some of the minor machines (such as the swaging machine which must be accurately built to give the desired results) which are playing an increasingly important part in our work.

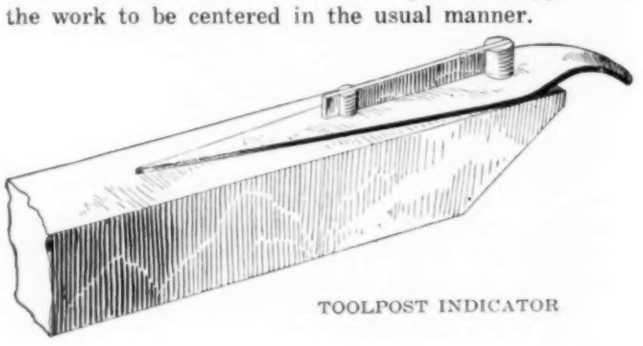
After talking with many builders of what we normally call machine tools, it seemed as though most of them desired a classification rather than a definition.

Indicator for Truing Up Work on Lathe

By Adolph Grimm

The illustration shows an indicator such as is used for centering lathe work. It can be made by any mechanic and if the work is carefully done the tool will be quite accurate.

The indicator is held in the toolpost and applied to the work to be centered in the usual manner.



TOOLPOST INDICATOR

The Human Element

By Elmer W. Leach

WHEN Kaiser Bill started so much trouble a few years ago it was quite apparent to everyone that he had absolute confidence of victory. He was playing a game for which he had made many, many years of preparation and with the science of which he was thoroughly familiar.

His long range guns and his intricate concrete trenches and dug-outs were believed to be infallible and impregnable. No one who has had the experience of going into those dug-outs and seeing the electric lights, the ventilating systems, and such luxuries as pianos and pool tables will say that Heine's head was thick and flat like his feet.

But when the doughboys got into the game they simply spoiled everything for poor Heine. The very first one of the "big shows" taught them that concrete trenches are no stronger than the men holding them, and long range guns no better than the fellows who man them. And after the boys got that idea they had caught the winning spirit, and all Germany couldn't stop them.

Viewed for what it was called, "a war machine," the German army was wonderful. The construction of their guns, their shells, their planes, was wonderful. The German army did not fall down through blunders in mechanical design, decidedly not. Every time the German army made a big mistake, it was a mistake in psychology—they didn't get the right advance dope on what their men would do under the circumstances.

Uncle Sam understands men; his army is not a "machine" nor is it advertised for its well-developed machinery or ordnance. No, our old Uncle Samuel takes due recognition of the human element in his army and pins his faith on his good, strong, red-blooded American men.

No government can guarantee the comforts of home to men under fire, but the fact that so many poor devils were tickled to death to be taken prisoners by our men seemed to let the cat out of the bag. Von Hindenburg failed to realize the true importance of his men, and so he did not have them back of him in spirit or in deed. As for our American commander, the public knows by now what the boys endured for him so that we might gain the victory which we all wanted.

"We ought to be able to get it for you—we're the biggest cold-roll people in the world."

Now all of this is merely the introduction to my article proper. Maybe it is too lengthy, but here is what I am driving at—how many manufacturers there are just like Kaiser Bill who are foolish enough to believe they can be successful in business by worrying about their machines and forgetting about their men.

Recently when I called on a local representative of one of the large steel companies in an attempt to locate some particular sizes of cold-rolled steel, the young lady who was alone in the office said, "Well, we ought to be able to get it for you, we're the biggest cold-roll people in the world." And I replied, "Well, we're the smallest machinery people in the world." And we are. Another company in this city making the same sort of machinery has about 300 men on the payroll. We have 11 men on our payroll including the writer and one other member of the firm; so you see that as yet we really are pretty small.

About two months ago the assembly foreman from this other company came to us saying he was looking for work. Figuratively we were knocked off our feet. He had been with that company seven years, now had about 25 men under him, his work was entirely that of supervision; and yet here he was asking us to take him on.

We put him to work doing our assembling, and frankly, I have never seen a man so interested in a "job" as this man is.

Last week we advertised for lathe men and we suffered another shock, for among those who applied for work was the crack screw-machine operator from this other plant. He wanted to come with us in preference to staying with the larger place. I had quite a talk with him before taking him on. I said to him:

"C——, I worked for that company for five years myself. During that time I received raises in pay, I was promoted, they sent me to conventions for them and out on the road to the four corners of this country. I was pretty young, but they trusted me with all the responsibility I would accept. I left them not because I had some grudge against them, but because I was presented with the opportunity of going into business for myself.

"You say you are dissatisfied over there. Well, we haven't the beautiful and well-equipped buildings that they have, we haven't the new and up-to-date machine tools they have, we haven't any of the luxuries or conveniences you can get over there. We can't promise you piece work right away, we can't promise you that you can look forward to a foreman's job for as yet we haven't any foreman, in fact, we can't even start you out with as much money as you are getting over there. And yet you seem anxious to make the change."

THE SENSIBLE WORKMEN HAVE RAISED FAMILIES AND BOUGHT HOMES OF THEIR OWN

I had been over to visit this company's new plant less than a month before. It was beautiful. I believe their new machine shop is the finest one I have ever seen. And so I couldn't help asking in conclusion, "What in thunder is the matter with that place anyway?"

And so he told me his story of why he was dissatisfied, and why he was willing to go from such a large plant to such a small shop.

He said to me, "I'll tell you, Leach. I went with them three years ago as a machinist. You were with them at the time and you know what they did when the shop foreman quit and got a job with the steel company because he was more sure of being exempted over there, they hired some outsider and put him in as foreman. Later on they needed an inspector, and again it was an outsider with no knowledge whatever about this game. When their assembly foreman left them a couple of months ago to come over with you they tried to make a foreman out of some outsider who didn't know that kind of machinery from balloons. And what happened? That Saturday two men on the floor were fired and five others quit, and on Monday morning Mr. New Foreman came in and got his tools.

"They even advertise now for jig designers and toolmakers without stopping to inquire whether any of us fellows know anything about that sort of thing.

"I know what their idea is. They say outside men bring in outside ideas, and that puts new life into the business. Maybe it does, but it sure takes the pep out of us boys at the machines. The 'Steel' gives a hundred dollars each month to the man who turns in the best suggestion. Maybe I could offer a few sincere suggestions about things I see that aren't going just right, but why should I when the 'Supe' would get all the credit?

"And their bonus system. It was a flat 10 per cent of our pay paid each six months. It was pretty nice to have those big checks to look forward to, but we knew we had them coming whether we worked or loafed, and honestly, I don't believe the company got any increased production out of us.

"So they cut that out and put us at piece work. We thought that was going to fix us up in fine style, but I have tried it for two months now and their rates are so impossible that I haven't made one cent more than I did on straight salary."

He probably said many more things and he might have had a lot of kicks he didn't tell me about; but he said quite enough to point out the "nigger in the woodpile." That organization is putting a lot of capital into plant and equipment, and is not spending one cent of money or one minute of time in the interest of the welfare of the employees.

We are gravely concerned at this present time with the problem of "unrest." It seems to me that what the men are asking is this, "Just give us a square deal, that's all we want. If we make lots of money for you, go fifty-fifty on a part of it. If we make still more money for you, take care of us a little better. Put part of it into our pay envelopes, and part of it into real, honest, human-being treatment."

Of course that isn't the complaint of the radical, "hollering" group of today. But the writer is proud to wear the button of a Legionnaire, and men who have slept in mud are not bothering to listen to the kicks of such grumblers.

But the sensible workmen, those who have put in long years learning a skilled trade, those who have raised families and bought a little home of their own, those who really have something at stake in this good old country of ours, all they are asking for is a square deal.

There was a time when a manufacturer talked of labor as the same kind of a commodity as tool steel or milling machines. True, labor is a commodity, but it is more than that; it is the human element in our business, the largest item in our check books and the most important factor with which we deal. We are good enough to put cooling compound on our tool steel to keep it from getting hot and we give the milling machines a squirt of oil each morning so they won't holler. And can't we realize that it is far more profitable and much less expensive to keep our men from "getting hot and hollering."

As I said before we are pretty small, with our payroll of only eleven men. But recently one of those men showed us a saving of sixteen cents a machine on one of our products by getting away from a certain waste of material, which we had not noticed was unnecessary. It amounts to a saving of several dollars a week, and we are putting five of those dollars into his check each week to show him we want more of those ideas.

Another young man showed up one noon with cigars and the announcement of an eight-pound baby girl at his home. We put five cents an hour more on his checks after that noon on the assumption that he would want to work just a little harder with that little girl at home. And the way he "digs in" has shown we were correct. None of his jobs have increased in cost because of that five-cent increase in hourly rate.

Our attorney is drawing up for us what we plan to call an "Investment Certificate." It will amount in a way to a hundred-dollar share in the business, although it will, of course, carry no voting power. We shall probably give one of those certificates to each man who is with us for a certain length of time, and to all the men we shall extend the privilege of buying as many more as they can afford. The dividend, as on common stock, will increase in proportion to the profits of the company.

We got the idea from a concern with about a hundred people. The secretary told the writer that the first month the plan was tried out those one hundred people scraped up the sum of $28,000 and invested in those certificates.

What we like about the idea is that it gives each individual an incentive to do as much as he can with the knowledge that he will profit in real money in his pocket through his endeavor to make money for his employer.

Maybe we are all wrong. Kaiser Bill would probably have told us so back in 1914. At any rate, we are going to get some new machines and a new building as soon as we can; but right now we are going to try to give the proper regard to the human element and invest a little money in a good, sound, dividend-paying business deal—the square deal.

Notes From Our Field Editor—Machinery in Portland and Seattle

The machine situation in the extreme Northwest, with centers about Portland and Seattle, is somewhat different from that found further down the coast. There is more of an air of retrenchment and uncertainty or pessimism as to the future than was evident in either Los Angeles or San Francisco.

The Portland shipbuilding program is practically completed but it so happens that one of the plants, that of the Willamette Iron Works, made such a record during the war that it is still filled with orders for boilers for ships being built in San Francisco. In Seattle, however, the shipbuilding business is practically at a standstill, this being attributed in some quarters to the failure of the banks and moneyed interests to back up a local concern which had secured orderes for enough ships to keep its yard going at a good rate.

This has its effect on the demand for machine tools and, coupled with a growing caution about placing orders for future delivery, has slowed down orders and inquiries. Unfortunately, there is not much manufacturing in either Portland or Seattle, although there is more machinery used in connection with the lumber interests than we of the East are apt to realize. Logging and saw-mill machinery, to say nothing of the machinery used in wood-working plants, all require more or less repair and replacement, and this means machine tools and smaller supplies, such as drills and taps.

Building Wood-Working Machinery

Wood-working and logging machinery is being built in increasing quantities in spite of the handicap of not having raw material as a native resource. This handicap is believed by some to be possible of removal as it is hoped that iron may be produced in sufficient quantities and of the proper quality, to meet the requirements. Lack of transportation facilities is said to be the greatest obstacle at the present time. Coal mines exist and are being worked to some extent but not sufficiently to be much of a factor as yet even though over four million tons are claimed for them. Then, too, it is uncertain as to the coal being suitable for smelting purposes. In spite of this, however, machinery of types similar to that built in the East, is being manufactured in increasing numbers.

The garages are equipped in much the same way as further South. Cylinder and crankshaft grinding machines, together with other high-class equipment, are found even in comparatively small shops. But real manufacturing shops, even of small things, are fewer than in California. In view of this and of the apparent lack of opportunity for machine sales, it is surprising as well as gratifying to learn that the estimated sales of machine tools in Washington and Oregon, are about a million and a half dollars annually. This, of course, includes Spokane, which is my next stop and which may have somewhat different conditions.

Another factor which is affecting this district is the situation in the fish industry, which, next to lumber, is probably the greatest industry in this section. The sale of canned fish to foreign countries has been very large in the past but the handicap of the present rate of exchange has affected this so badly that canning and canning machinery is more quiet than it has been for some time.

Thirty Millions in Idle Ships

Coming back to the question of shipping, it is interesting to note the claim that Seattle built and delivered to the Government 20 per cent of all the merchant vessels built by the United States during the war period. Whether this includes the 45 wooden ships now lying anchored in the harbor, in various stages of completion, is not known.

The building of these ships is said to represent about $30,000,000, which probably includes yard equipment in addition to the ships themselves. But no matter what it represents, it is a striking example of the inevitable cost of war, and should give an added incentive to the efforts being made to find a more economical (not to mention humane) method of settling national differences. Thirty million dollars would go a long way to help our educational systems, our post offices, our public roads or other useful projects for national benefit.

The field for machine tools is increasing, however, and is bound to grow in spite of temporary set-backs. It is a great mistake not to keep in touch with this section of the country as it is well worth knowing better.

Horizontal Boring Machines for Manufacturing

By FRED H. COLVIN
Editor, *American Machinist*

It has been the custom to consider the high-grade horizontal boring machine as a part of toolroom equipment or at most to be used where there is quite a variety of work to be done. This article, however, shows how one of the largest builders of motor cars and motor trucks uses it as a strictly manufacturing machine.

WHILE the use of high-grade horizontal boring machines in manufacturing is unusual, it is even more so to find them staggered in the same way as is usual in automatic screw machines. Fig. 1 shows a general arrangement of five Lucas boring machines grouped for motor-truck work. The machine in the foreground is set up with a special boring fixture for handling the worm-gear drive bracket shown in Fig. 2. This carries the worm at the top, while the bearings for the wormwheel, which drives the rear axle, are carride in the two bearings *A* and *B*. This shows the construction, including the way in which the bearing caps are held in position.

The fixture is mounted on the revolving table shown at *A*, Fig. 1, which can be easily swung at right angles, so that the boring-machine spindle can drive either boring bar in its correct position and secure the proper meshing of the worm and wormwheel.

A Ball-Bearing Fixture

A view of the fixture itself is shown in Fig. 3, with the two bars in position, while Fig. 4 shows it with some of the cutters in place, at *A* and *B*, as well as the stops such as at *C*, *D*, *E* and *F*. The form of cutter used is shown in the group at *G*, some of these being for straight boring while others are simply counterbores,

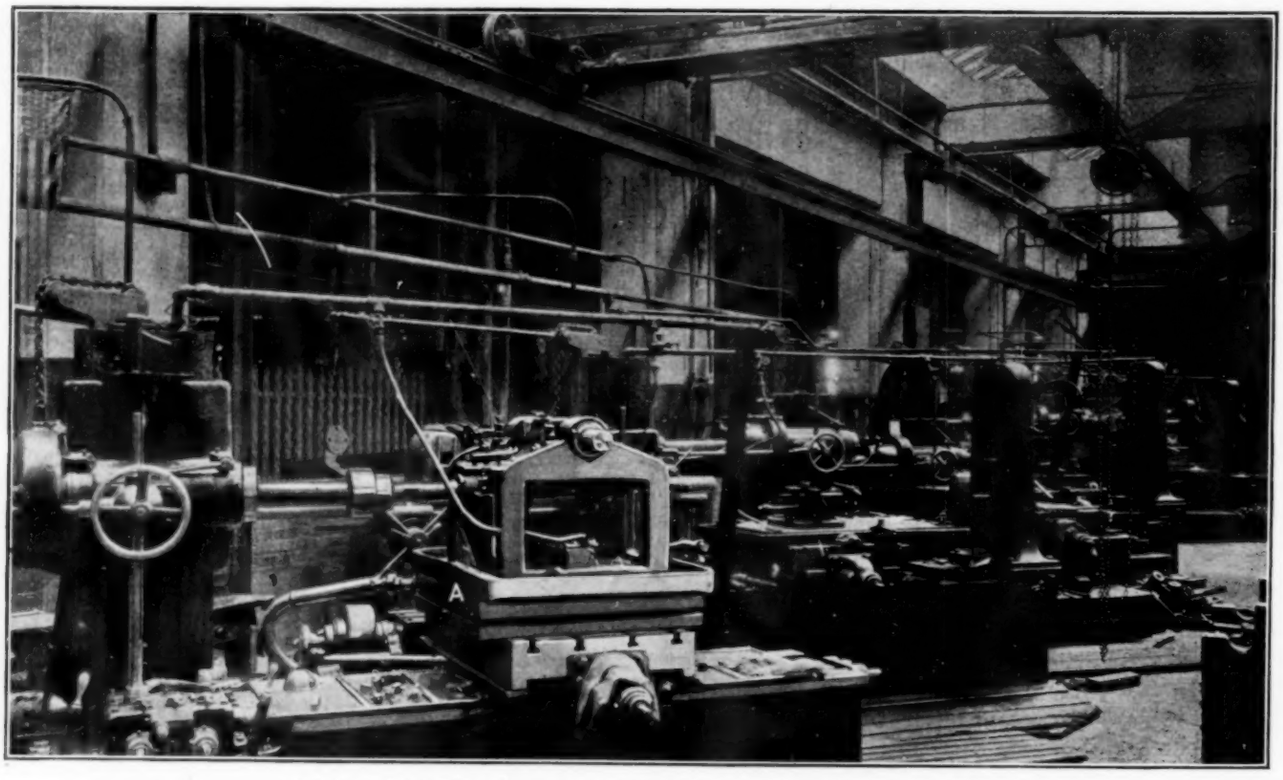


FIG. 1. GENERAL VIEW OF BATTERY OF BORING MACHINES

AUTOMOTIVE CONSTRUCTION

FIG. 2. THE WORM-GEAR BRACKET

which are used for what we might call back facing. It will be noted that each bushing is provided with ball bearings and an oil cup to insure thorough lubrication, to prevent abrasion of the bars, and to insure accuracy and long life.

Details of Construction of Fixtures

Details of the construction of these fixtures are shown in Fig. 5, but particular attention should be directed to the bearings shown in section. These bushings are mounted on large double-row self-aligning SKF bearings, and oil grooves are provided at each end for retaining the lubricant. It will also be noted that return

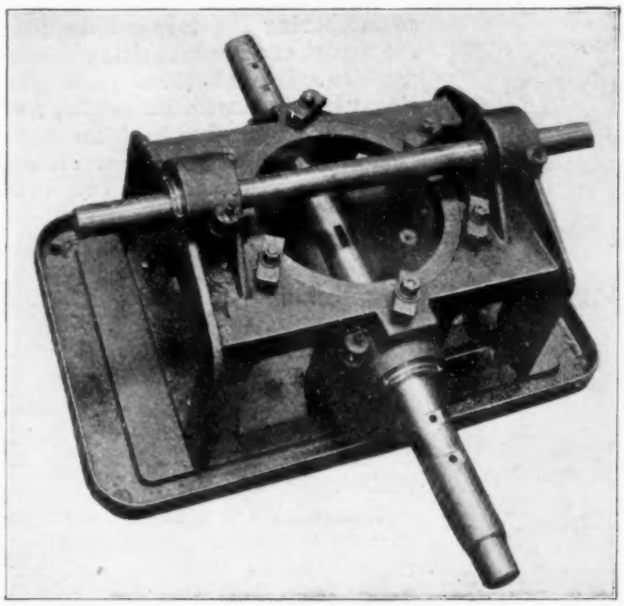


FIG. 3. BORING FIXTURE WITH BARS IN PLACE

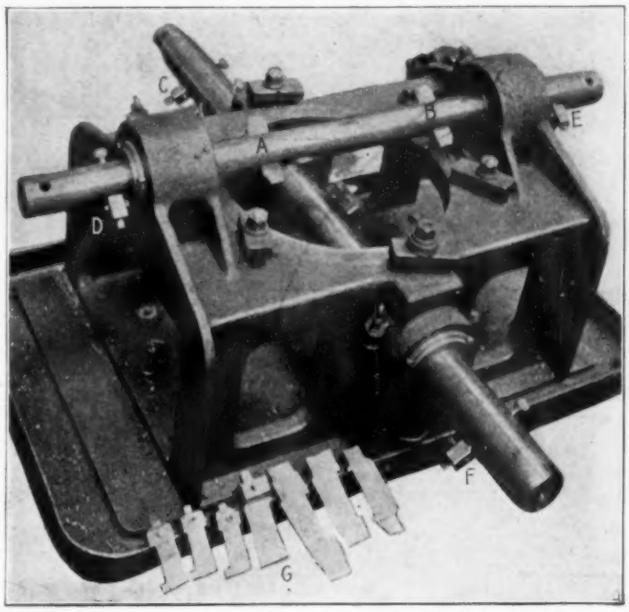


FIG. 4. CUTTERS AND STOPS IN THE BARS

oil holes are provided as at *A*, *B* and *C*, so that oil can hardly escape beyond the first groove in any case. A few outside dimensions are given to give an idea of the size of the fixture.

In order that the bolt holes and dowel holes in the driving housing shall be in correct relation to the worm and worm gear, special attention is paid to the fixture for drilling these holes in the flange. Fig. 6 shows the assembled fixture. The seats for the wormwheel bearings are carefully located on the cones *A* and *B*, these being located on an accurately made mandrel which fits the pocket at each end, as can be seen. These are faced with hardened-steel plates to secure accuracy, while the turned flange of the gear housing rests on the drilling fixture and is clamped in position by the four clamps *C*.

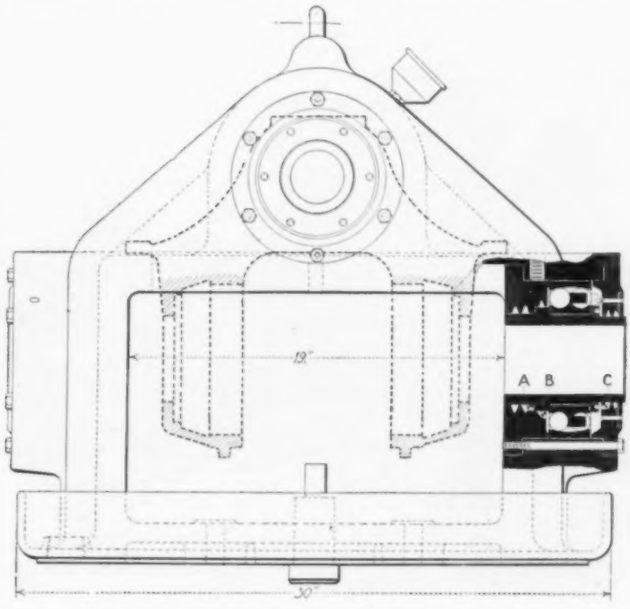


FIG. 5. DETAILS OF BORING FIXTURE

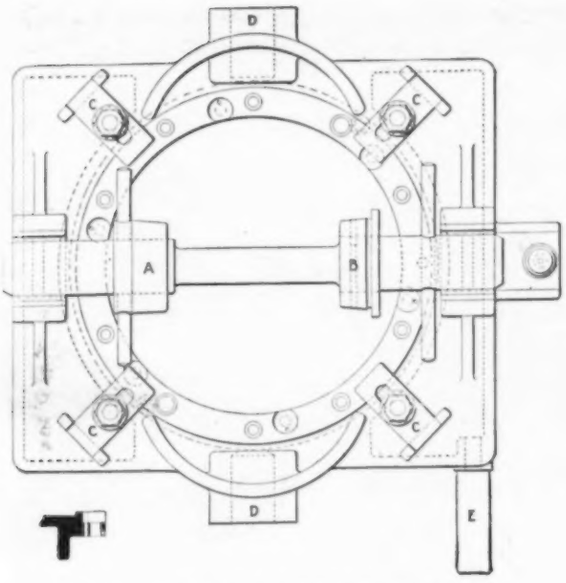
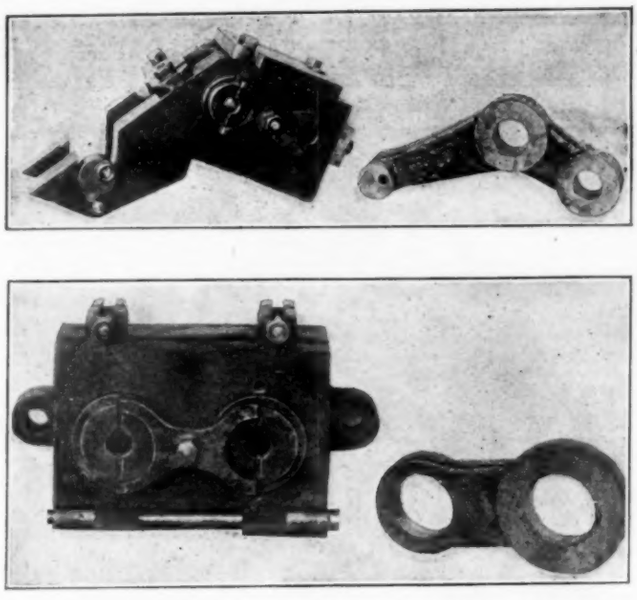


FIG. 6. DRILLING FIXTURE FOR FLANGE



FIGS. 2 AND 3. DRILLING JIGS FOR TOGGLE LEVERS

The fixture is handled by studs placed in the pocket *DD*, while the handle *E* affords a good grip and allows it to be easily guided into correct position on the drilling-machine table or elsewhere.

Some Special Jigs Used in the Manufacture of Pneumatic Tools

By Harry Fox

In the manufacture of pneumatic tools, the Baird Pneumatic Tool Co., of Kansas City, uses several hundred jigs, three of which are here illustrated.

Fig. 1 shows a tool for boring, turning, and facing the shoulder of a brass bushing, all in one operation. It is designed to be bolted to the compound rest of the lathe to which it is adapted by a pair of studs set in a T-shaped strip, fitted to the T-slot of the slide, the height being so calculated as to bring the center of the tool to the center line of the machine and centered up cross-wise with the tail center.

Four toolbits disposed at an angle of 45 deg. are set in the shell. One-sixteenth of an inch in advance of these bits there is placed a hardened ring gage which is the exact outside diameter of the finished bushing. This also acts as a steadyrest for the bushing. The bits are held by setscrews in suitable bosses cast upon the shell and serve to turn the outside of the shell, while four shorter toolbits in the central head take care of the boring. There are four guide pins spaced in between the four last mentioned toolbits.

The bronze casting is held in and rotated by the chuck upon the spindle nose while the carriage is advanced by means of an automatic feed. A bushing is therefore finished complete in one pass of the tool on and off the work.

Two of each of the two sets of four tools are so arranged as to remove the stock, leaving $\frac{1}{32}$ in. for finish, which is in turn taken off by the other two sets of cutters, thus finishing the bushing inside and out to the exact diameter. The finished bushing is shown in the picture to the left of the tool.

In Figs. 2 and 3 may be seen jigs for drilling and counterboring the toggle links that are a part of the pneumatic riveting machine. One of these is of the closed box type with hinged lid, and the other is open box with the work held in place by swinging, or bridge-links, of which there are two, both carrying drill bushings.

Both these jigs are fitted with slip bushings held in place and prevented from turning by spring yokes. The jig shown in Fig. 3 has an adjustable bushing for drilling the eccentric hole in the knuckle. The holes served by the bushings in the bridges are for setscrews and absolute accuracy of their position is not always essential.

These jigs are used in the manufacture of parts of the Baird Pneumatic Tool Co.'s product and were designed by the factory superintendent, W. T. Flood.

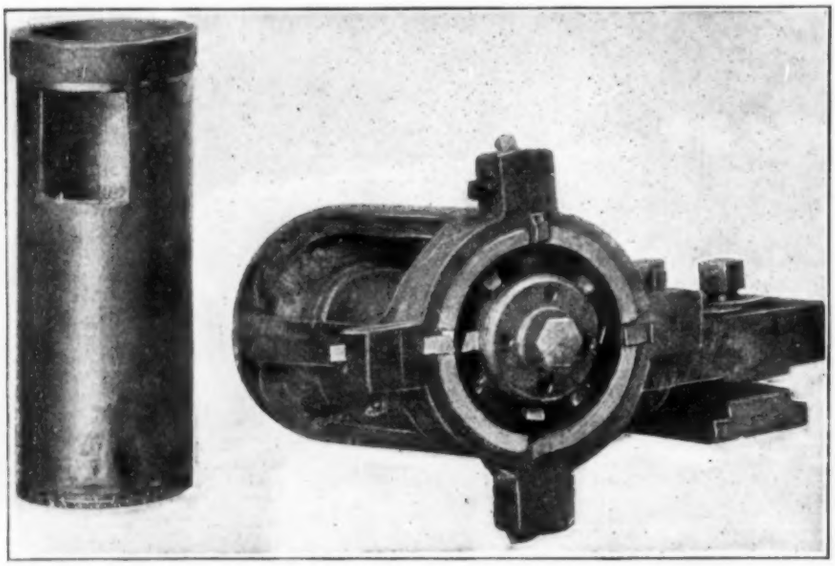


FIG. 1. TOOL FOR TURNING, BORING, AND FACING A BUSHING

Planing a Large Gear With a Small Planer

By George G. Lennig
Master Mechanic, Electric Hose and Rubber Co.

In order to salvage several large cast-iron cut-tooth spur gears from which teeth had been broken, the mechanical department of the Electric Hose & Rubber Co. of Wilmington, Del., used the method here described, with satisfactory results.

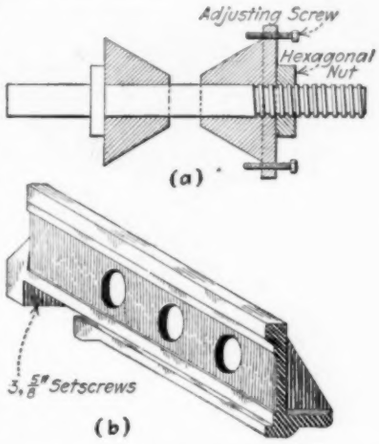


FIG. 1 (A). MANDREL FOR HOLDING GEARS. (B) ARM FOR HOLDING TOOL HEAD

The broken teeth were filled in by the oxy-acetylene welding process. A special mandrel, shown in Fig. 1 (a), was made, having a flat-topped coarse thread that would not be injured by coming in contact with the V-blocks. Upon this mandrel the gears were mounted one at a time. As some of the gears had been faced on only one side of the hub, it was necessary to have a flange with ⅜-in. screws in it, on the cone used on the rough side, in order to be able to make the gear-rim run true with the axis. The gear, after the mandrel was fastened in it, was blocked up on a crib with V-blocks under the mandrel, as shown in Fig. 2. After being adjusted and aligned with the planer bed, the gear was secured in place by several small planer jacks acting on the teeth.

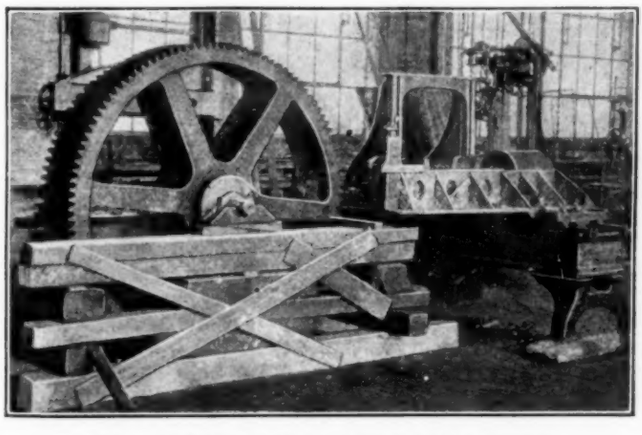


FIG. 2. SET-UP FOR PLANING GEAR TEETH

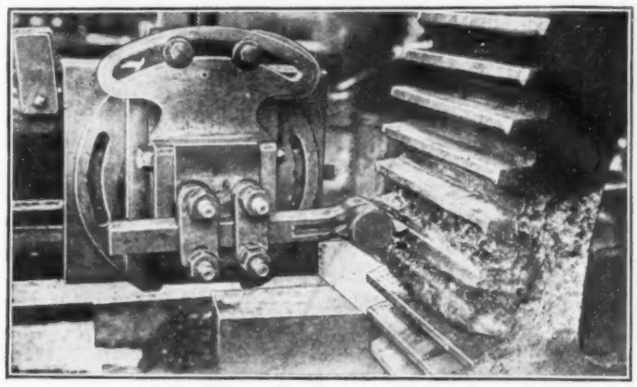


FIG. 3. VIEW OF THE TOOL AND THE WELDED TEETH

The cast-iron arm, shown in Fig. 1 (b), was bolted to the planer bed and the cross-rail and head were fastened to it, as shown in Fig. 3. The table was weighted down with about a ton of forgings, and it was found necessary to slow the planer down to about one-quarter of its customary speed. The cast-iron arm was not made especially for this job, being used on general repair work. It did not need to extend as far as it did from the planer table. However, there was very little vibration.

The gear shown has a pitch diameter of 72 in. and a 14-in. face and weighs about 3,800 lb., and when in operation it is geared direct to a 150-hp. motor on a rubber-mill drive. The planer is an ancient 26 x 26 in. Pratt & Whitney machine with a 6-ft. bed; notwithstanding its years, it is a strong puller and remarkably accurate for such an old tool. Several methods, such as chipping with air and hand hammers and grinding with emery wheels, have been tried for finishing welded teeth, but so far the method just treated has been found the most satisfactory.

Lathe Equipped with a Boring Table

By E. A. Dixie

The illustrations show an old Pratt & Whitney lathe whose principal job for many years has been accurate boring, usually on models from which boring jigs are made to suit the production machines. In spite of the

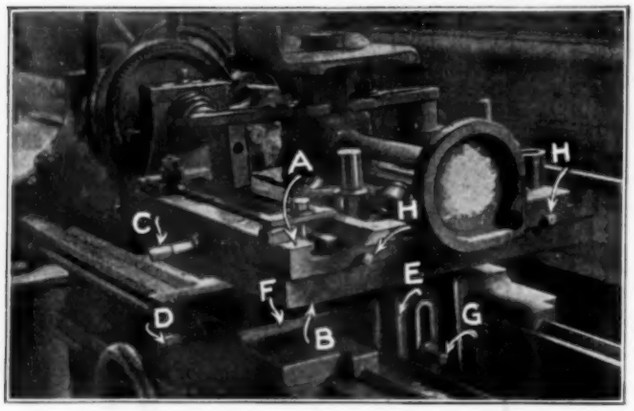


FIG. 1. LATHE EQUIPPED WITH A BORING TABLE

fact that we have several first-class horizontal boring machines, the old P. & W. lathe is seldom idle.

The table *A* is 20 x 20 in. and slides on the base *B* across the bed. The end of the cross adjustment screw is shown at *C*. The squared shaft *D* runs to the center of the base and has a bevel gear which meshes with the elevating screw. Two vertical members *E* are disposed on each side of the bridge *F*, their upper ends being secured to the base *B* and their lower ends bound together by a yoke. Slides for the members *E* are provided on the deep bridge *F*. When adjusting for height two binding screws *G*, one on each side of the bridge, are loosened and the table adjusted to height by a crank applied to the square shank *D*. When the correct height is obtained the screws *G* are tightened. The cross slide is provided with a gib which is adjusted by the two screws *H*. These screws are loosened for adjusting the cross slide, and when correct cross adjustment is obtained they serve to securely bind the cross slide in place. At present this machine swings about 20 in., but the foreman in charge of the department tells me that he is going to block the heads up so that the machine can handle work 36 in. in diameter. This means of course to the center of a 36 in. circle and not to bore holes of that diameter, as the machine is neither stout enough nor is it required to bore such large holes, its capacity in that direction being about 12 inches.

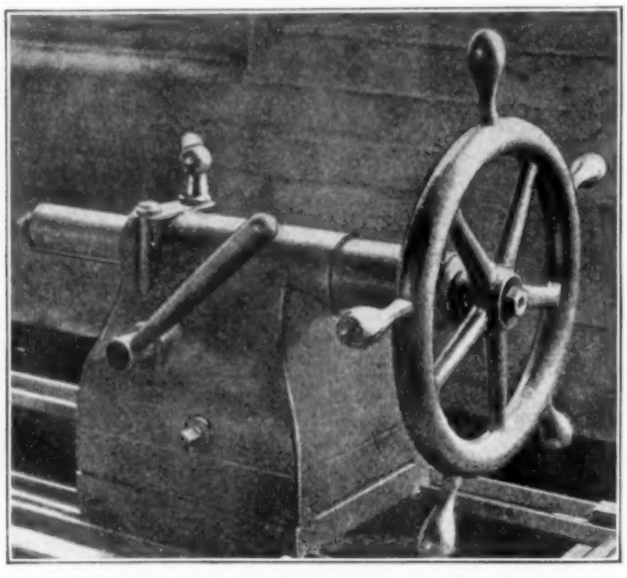


FIG. 2. SENSIBLE HANDWHEEL FOR THE TAIL SPINDLE OF A BORING LATHE

Formerly this lathe was much used for boring with tools secured in or clamped to the tail spindle. Any one who has done this sort of work with the ordinary smooth round-rimmed handwheel knows what a tedious job it is to feed the tool. Some oldtimer not only put a big handwheel on the tailstock but he also put pilot-wheel spokes in it as shown in Fig. 2.

Is This a Punch-Press Job?

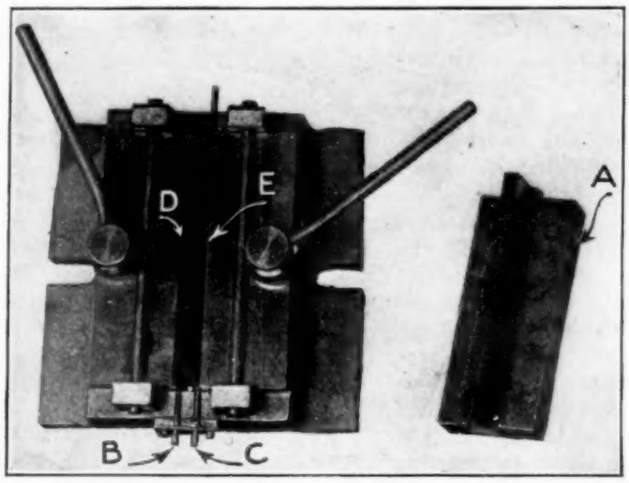
BY JORAN KYN

Under the above title on page 1267, Vol. 52, of the *American Machinist*, F. C. Hudson shows a rod with a flat on it and says he is punching the flats on two rods at once.

Will Mr. Hudson tell us how successful his method has proved?

We undertook a similar job and tried punching but the punch broke, the break being shown at *A* in the accompanying illustration in which the construction of the press tools is also shown.

The two rods *B* and *C*, were placed in grooves in the



THE PRESS TOOLS, SHOWING THE BROKEN PUNCH

die and firmly held by the clamps *D* and *E*. Perhaps our punch did not have enough shear. At present we are milling the flats on the rods, but are looking for a better and cheaper method.

Is there any way in which the work can be done by cold swaging? Any suggestion as to the best and cheapest way of doing the job will be welcome.

Flanges for Friction Pulleys

BY JOHN S. WATTS

THE designing of cast-iron flanges for friction pulleys appears a simple problem at first sight, but it is not so in reality, for unless the stresses on the bolts and flanges are carefully considered the probability is that they will be made too light and ultimate failure will result.

The weakness in most designs is that the bolts are made too small, the size apparently being based on the theory that the shearing stress on the bolt is the governing factor. Experience in operating these friction drives, however, has proved that the bolts carry the load as a beam with a uniformly distributed load.

This is the basis upon which the table, Fig. 1, has

been calculated. The load upon the bolts is that due to the tractive effort on the face of the pulley multiplied by the ratio between the radius of the pulley and the radius of the bolt circle. With a cast-iron pulley and a strawboard or fiber pinion the maximum tractive effort will be about 80 lb. per inch of width, but to make sure I have used a factor of 100 lb. per inch.

To find the load on the bolts we use the formula:

$$L = \frac{P \times A}{B}$$

Where L = load on bolts in pounds;
P = pull, or tractive effort on pulley face;
A = diameter of pulley in inches;
B = diameter of bolt circle in inches.

This load is assumed to be equally distributed among all the bolts and the diameter of the bolts is determined by the formula for a beam with a uniformly distributed load supported at each end, which formula is:

$$\frac{L}{n} = \frac{8 \times f \times Z}{l}$$

Where f = stress;
Z = modulus of section of bolt;
l = length between flanges;
n = number of bolts.

Obviously, the diameter of the bolt calculated from this formula will be more than strong enough to resist the shearing strain.

The diameter of the flanges is such as to allow a projection of ¼ in. of fiber above the flange for the smallest diameter and it may extend up to 2 in. above the flange as a maximum. This gives the greatest possible range of sizes for the smallest number of flange patterns, as the fiber cannot be depended upon to withstand the strain if allowed to project further than two inches. The sizes given in the table are therefore suitable for all sizes of friction pulleys up to 18 in. in diameter which is as large as fiber frictions are usually made. The two largest sizes of the pulley flanges given in the table are for use with wood pulleys, the purpose of which will be taken up later. At the same time these two largest sizes may be used for friction pulleys and are calculated in the same way as the others.

The face of the fiber is made ½ in. wider than the working face of the cast-iron pulley it is to drive, to prevent any danger of the cast flanges coming into contact with the pulley as the fiber becomes worn down

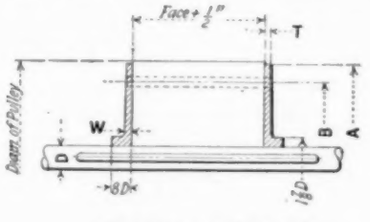


TABLE OF PULLEY FLANGES

Diam. of Pulley	A	B	BOLTS 9" Face	12" Face	14" Face	16" Face	18" Face	20" Face	22" Face	24" Face	T	W
6" to 9½"	5½"	3½"	Four ⅜"	Four 1"							⅝"	¾"
10" to 13½"	9½"	7¼"	Four ⅜"	Four ⅝"	Four 1"	Four 1"	Four 1⅛"	Six 1"	Six 1⅛"	Six 1¼"	¾"	⅞"
14" to 17½"	13½"	10¾"	"	"	Four ⅞"	"	"	"	"	"	¾"	1"
18" to 25½"	17½"	14¼"	"	"	Four 1"	"	"	"	"	"	¾"	1⅛"
26" to 35½"	25½"	22½"	"	"	Four ⅞"	"	"	"	"	"	¾"	1"
35½" to 72"	35½"	32"	"	"	Four 1"	Four 1⅛"	Four 1¼"	Six 1⅛"	Six 1¼"	Six 1⅜"	⅞"	1⅛"

FIG. 1. TABLE FOR COMPUTING BOLT SIZES FOR FRICTION DRIVES

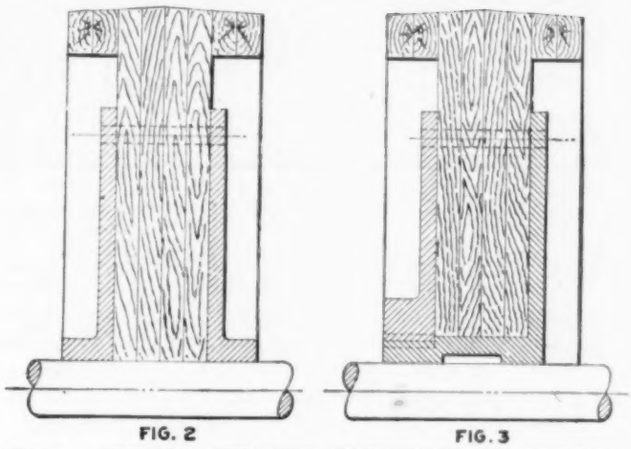


FIG. 2. SECTION SHOWING CONSTRUCTION OF WOOD PULLEYS FOR EXTRA HEAVY WORK. FIG. 3. ARRANGEMENT OF FLANGES WHERE SPACE IS LIMITED

in size. The thickness of the flanges at the rim is calculated for a maximum compressive stress imposed by the bolts of 2,300 lb. per square inch, basing the calculation upon the load due to the widest face—namely 12 in. face for the pulleys, 6 to 9½ in. in diameter, and 24 in. face for the other sizes. When a narrower face is used the stress will be less but it would not pay to carry more patterns for the small amount of material that would be saved by having thinner flanges for the narrower faced pulleys.

The thickness of the flange where it joins the boss is that calculated to withstand a pull of 100 lb. per inch of face with a maximum stress of 2,300 lb. per square inch. This thickness is determined by calculating the diameter of the smallest shaft that will transmit the torque which the narrowest pulley can impose. This gives the smallest boss that will be used and calculating the load at the diameter of boss due to the tractive effort on the face of the largest pulley will give us the maximum strain at this point. The thickness of the flange, multiplied by the circumference of the boss and by the stress allowed of 2,300 lb. per square inch, must equal this maximum strain.

The sizes of the boss are determined by the diameter of the shaft, and the patterns should be made with the boss loose so that the different diameters of bosses can be attached to the pattern to suit varying diameters of strength if made equal to one and seven-eighths times the diameter of the shaft and the width of the boss should be 0.8 times the diameter of the shaft, which will make the keys in the two flanges capable of transmitting the full strength of the shaft.

For work in cold climates the regular cast-iron or steel belt pulley will not grip, owing to frost coating the surface of the pulley with a thin coat of ice, and it is therefore necessary for saw mills and stamp mills at gold mines, where pulleys may have to work in very low temperatures, to use a pulley built of pine or spruce and nailed—not glued—together, as shown in Fig. 2.

As the maximum belt pull will be about 90 lb. per inch width of face the same pulley flanges will do for the belt pulleys as we have specified for friction pulleys; but the larger sizes of belt pulleys usually are made with the outer face overhanging three inches or so on each side, thus reducing the stress on the bolts.

For extra heavy work, such as the driving pulleys on a large stamp mill, a somewhat more expensive style of pulley flange is used, like that shown in Fig. 3.

EDITORIALS

More Machine Tools for Airplane Work

THE latest development in airplane construction is full of promise in many ways. The all-metal planes which are now flying in various parts of the country make, according to one of the most successful plane builders, all our existing planes out of date and obsolete

The new planes are not only more substantial and free from dangers from fire, but are surprisingly more efficient in every way. The single wings, for it is a monoplane, are internally braced and are so rigid that they require no guy wires or outside supports of any kind and yet are almost unbelievably strong.

This elimination of guy wires and outside struts, cuts down the parasite resistance to such an extent that the performance per horsepower, both as to weight carrying and speed, is far ahead of anything which has gon before. This, as well as its increased durability, of course, brings the commercial uses of the airplane in many fields appreciably nearer. For in place of the ribs built up of small wooden sections, and their covering of cloth, we have a mechanical construction of far greater strength and durability.

It is only fair to those whose efforts developed the present wooden and cloth construction, to give them full credit for the way in which they secured ribs and wings which were remarkably strong when we consider the material and the many small pieces used in the building. But just as the steel car has replaced its wooden predecessor—so must the metal plane come into its own as soon as the necessary materials can be secured in sufficient quantities.

The machine-tool builder is particularly interested in the advent of the metal plane, because it directly affects his business. Metal plane construction means the installation of metal-working machines, either machine tools themselves or machines which must be made by them. In any case the machine building industry is bound to be directly affected to an extent which was impossible as long as the wood and cloth construction held sway. This is a matter for congratulation, not only because of its direct value to the machine building industry, but because it marks a decided advance in the service which we may expect from airplane development.

F. H. C.

Interchurch Report on Steel Strike

THE Interchurch World Movement, for some time looked upon with suspicion by sober-minded church and non-church people, has deepened this suspicion by its recently issued report on the steel strike. While the report is sponsored by Bishop McConnell, Dr. Daniel A. Poling, Dr. McDowell, Bishop Bell, Bishop Williams and others, there is no evidence that these men did any investigating of actual conditions on their own account. Instead, they depended largely on the reports certain "investigators" made to them. These investigators, some of whom have frequently contributed radical articles to newspapers and magazines, apparently set out to prove one side of the case only—and this against the steel companies. That some of the conditions in the steel district needed adjusting, no one acquainted with them will deny, but the report of the Interchurch Committee is so biased and so manifestly absurd in several instances that it is its own answer.

E. V.

Engineers and a Bamboo Fence

THE conference of engineering societies in Washington, D. C., June 3 and 4, which resulted in the organization of the Federated American Engineering Societies, brought out some very keen thought from many good speakers. Among them was Marshall O. Leighton, representing the Washington (D. C.) Society of Engineers, who used an illustration that is peculiarly appropriate in explaining the inertness of the engineer as concerns taking his rightful place in public affairs. Said Mr. Leighton: "A few days ago I read an account of an experience of Sir Charles Napier, who, in the course of an elephant hunt in Bengal, captured alive a number of fine specimens. He was perplexed by the problem of keeping his elephants confined pending arrangments for their transportation, and the difficulty was finally solved by following the suggestion of a native, which was to build a light bamboo fence around them. Those big animals powerful enough to have walked through that fence without even realizing that they encountered any obstruction, remained peaceably within the enclosure until their master had otherwise provided for them. For a long time prior to the reading of that account I had semiconsciously been seeking a visualization of the American Engineer. My search stopped right there. Engineers as a class—strong, intelligent, accomplished and well poised—have been confined by a bamboo fence. They have taken it for granted, as did Napier's elephants, that, because the fence is there, it must logically be strong enough to keep them within one enclosure."

It is not amiss to refer to this quotation, when at the same time referring to an invitation recently issued by the Joint Conference Committee, which is caring for the affairs of the F. A. E. S. (The invitation is published on p. 379). This invitation is issued to the engineering and allied technical organizations and asks them to become charter members of the federation. Such a move is getting down to definite action.

The invitation was not issued immediately, or even shortly, after the conference because it was desired to give the delegates time to get home with their reports, to give the press time to express its opinions and to give the committee time in which to formulate and mail data supplementing the reports of the delegates. All of these things have been done—and now action has been invited.

There remains to be disposed of, by the invited societies, the item of the bamboo fence which may be represented by any one, or a combination of several things. Among them are the failures to realize the intended scope and future value of the federation; incomplete knowledge of what this organization is and what it

stands for; reluctance to part with the dollar or dollar and a half which must be advanced for each member of a member-society.

This fence should not exist. Practically one hundred per cent of the technical and engineering magazines reported the Washington meeting in detail. The constitution and by-laws have been published in the *American Machinist* and in pamphlet form. The Joint Conference Committee has been busy with its publicity on the organization, so that no points should remain obscure. So far as the fee of a dollar or a dollar and a half is concerned, a little calm thought in which the small sum mentioned is visualized in comparison with the service —service to *somebody* (remember the object of the organization) which it will obtain, will show that this subject may be dismissed at once.

It is to be hoped that if the bamboo fence exists it will be torn up by no uncertain action, and that there will be a whole-hearted, favorable response to the invitation of the Joint Conference Committee.

L. C. M.

The Passing of Our Pioneers

ONE by one the pioneers of the machine-tool industry are passing away and in another column of this issue we regretfully record the death of Amos Whitney.

To many of our older readers—and alsa their number is growing less—the notice of Mr. Whitney's death will be read with sadness. No obituary less than a volume could do justice to the memory of Amos Whitney nor to the influence of his personality on the development of precision and labor-saving machine tools. As the shop executive of the Pratt & Whitney Co., Mr. Whitney has probably turned out more men who have filled executive positions in manufacutring establishments than any one man in the United States. Mr. Whitney's quiet, gentle and unassuming manner endeared him to a lot of friends. There are in existence several shops in Hartford started by him in connection with some of his old friends, ostensibly because he wanted something to do but in reality because he wanted to establish these same old friends in business for themselves. Such was his generosity, quietly performed and known only to those most intimately acquainted with him.

Our old-time mechanics—the pioneers of the industry —will all soon have passed away. Men like Amos Whitney, F. A. Pratt, J. R. Brown, Lucien Sharpe, Richmond Viall, J. H. Holloway, John E. Sweet, John A. Brashear, Alexander L. Holley, George R. Stetson and a host of others need no monuments to perpetuate their memories —their everlasting monuments are in their lives and their work, and the world is better for their having lived.

S. A. H.

A Question in Factory Management

By W. Burr Bennett

THERE is a moot point in factory management that the writer has never seen discussed in any article or in any text-book on management. To explain: all plants, both large and small, are from time to time confronted with the problem of establishing a department for a class of work which is new. For example, suppose we take the case of a shop that has never done any nickel plating.

It is decided to install a small nickel-plating department, even though at the time there is not enough work to keep one man busy continuously. The equipment is installed and the work comes along through the shop.

A man is needed and the factory manager or superintendent picks out a man who is given the proper training to handle the job. This man can handle all of the work, say in two hours per day, but it will be only a matter of time until the output of the shop will be great enough to employ him full time, with perhaps some additional help. Under these conditions, is it cheaper in the long run to put a man on this work for the two hours, letting him complete his day in his regular department, or to let him stay on the nickel-plating work all day, even though he is busy on actual production only two hours?

Disinclination of Men to Work at Other Trades

Of course we must discount the disinclination of men to go on any work outside of their trades and the edict of the trades unions to that effect; however, we would hardly put a skilled mechanic, such as a full-fledged pattern-maker on this work but rather an inexperienced man just starting in some department. Also we must forget the logical suggestion that if a plant has so little nickeling to do it should be done outside. We have taken nickel plating as an example and intend the question to cover only cases where the work cannot be secured outside.

Will Skill Be Developed?

In the first case the man will probably do only partial justice to the two jobs, while in the second he will develop such skill as is necessary by being right there when there is work to do and by keeping the equipment of the new department in working shape. Is the man actually creating a working asset by studying his job during the hours outside of his actual production, so that he will be able to go ahead rapidly when the work is needed, or is he a burden on the already long suffering "overhead"?

A small point in factory management, perhaps, but one that we have had to confront at least six times in the last year. What is the experience of other executives in this matter?

A Problem in Change Gearing

By N. C. Pickwick

WHILE there is, of course, nothing new in the method of finding change gears given by J. Crommell, on p. 832 of the April 15 issue of *American Machinist*, such contributions always bring to mind the value of the slide rule for problems of this kind. I have advocated the use of said instrument for this purpose for more years than I care to remember, and am glad to find its utility in this connection is now being more widely appreciated.

Take Mr. Crommell's second problem: to find wheels to cut 6.83 turns to 1 in. with a 7 lead screw. Set 6.83 to 7, and looking along the scales we find 40 and 41 are in almost exact alignment. Similarly, with the third problem; required 22 turns in 5.12 in. with a 5 lead screw. Setting 4.296 to 5, we find 55 and 64 are a better pair of wheels than Mr. Crommell's 30 and 35. Providing, as it does, a table of ratios, the slide rule lends itself admirably to all problems of this description.

WHAT to READ —for the man in a hurry

Suggested by the Managing Editor

AN ARTICLE differing somewhat from those usually featured opens this issue. It was written by A. J. Hanlon of the International Nickel Co. and is headed "Machining Monel-Metal Castings." It gives specifications for lathe tools for turning and threading monel-metal castings, treats of hardening, tempering and grinding the tools and gives information on lubricants. The occasional user of monel metal or the man who is using it for the first time will be glad to clip this article for his planning or production department.

Interest in technical educational ventures has been pronounced for many years, yet at present it is growing rapidly. "A Well-Developed Technical High School," by Fred D. Hood, page 343, tells of the objects and operation of the Los Angeles Polytechnic High School. This is only a short article, but add it to your collection of educational data and watch for others to come—there are several on apprenticeship courses being prepared.

"Superchargers for Airplane Engines," by Sanford A. Moss, begins on page 345. The greatest interest in airplane development at this time concerns its commercial uses. That the supercharger will probably play an important part in commercial planes is evidenced by quoting from the article. "The use of superchargers in commercial airplanes of the future is assured because superchargers will make possible far more miles per hour and more miles per gallon with a given engine and airplane, and speed is the main advantage of air over other kinds of transportation. It is thought by many qualified judges that by flying at a sufficient height with a supercharged engine and a suitably designed airplane a speed of 200 m.p.h. can be maintained."

"The Machinist and the Guard," by Val Klammer, page 348, is a reminder to the machine operator concerning guards which are designed and placed for his protection. Mr. Klammer says that safety is not obtained by simply placing guards on the machine, and that freedom from accidents is only attainable by guards *plus* something else—this something else being the co-operation of the machinist.

What to read was not a difficult matter to decide two hundred years ago when books were few and magazines unheard of. It is far different now when so much reading matter is offered to pass the time pleasantly or profitably as the reader chooses. We are doing our utmost to make the "American Machinist" not only profitable but indispensable as a clearing house of ideas and news of the machinery world. This page is the editors' advertisement of their section of the paper. It gives the high spots.

A retrospective article by Fred Colvin appears on page 349. To pause a moment to look over its illustrations and read the few explanatory paragraphs will provide a pleasing relaxation from the more technical pages. "Some of the Shipbuilding at New Orleans During the War" is the title of this story of war-time work.

There frequently exists the necessity for the shop or the planning department to quickly compute planing time. J. B. Conway has drawn a chart on which the time may be directly read, when the controlling factors are known. The chart and explanation of its construction and use are given in the article "Chart for Computing Planing Time," beginning on page 351.

H. H. Manchester's thirteenth part of the "Evolution of the Workshop" series begins on page 353. It deals with the decades from 1840 to 1860. The predominant influence of firearms on machine design and development and the progress of production on a "manufacturing basis" are described.

E. E. Hirschhauter, in "Toolroom System," page 358, presents a system which has been in successful use for the last five years in one of the biggest gas-engine shops in the country. System means everything in a toolroom. You may get just the tip you need from this article.

'Making a Pressed-Steel Base for an Electric Fan" is the title of H. Jay's article on page 361. "The manufacture of a pressed-steel electric fan base presents a problem that not only is interesting from the viewpoint of stamping but also offers a very good example of the economy of substituting this method of production for the casting or spun form," says Mr. Jay. This may be true of similar work which you are contemplating.

Plant papers have been the subject of much consideration as to their value and how to make them "take." S. F. Bowser & Co., of Fort Wayne, Ind., have thought out some stunts which are not at all bad. Frank H. Williams tells of them—page 363.

Elmer W. Leach has a "Human Element" story on page 365. It is worth reading for that pleasant glow of warmth it exudes, but it is otherwise valuable, too.

SHOP EQUIPMENT NEWS

-Edited By-
S. A. HAND

SHOP EQUIPMENT • NEWS •
A weekly review of modern designs and equipment

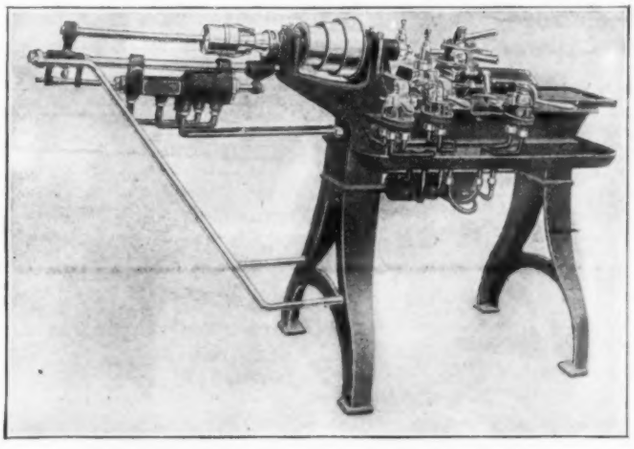
Descriptions of shop equipment in this section constitute editorial service for which there is no charge. To be eligible for presentation, the article must not have been on the market more than six months and must not have been advertised in this or any previous issue. Owing to the news character of these descriptions it will be impossible to submit them to the manufacturer for approval.

• CONDENSED • CLIPPING INDEX
A continuous record of modern designs and equipment

Moretti Hydraulic Turret Lathe

Alfred Herbert, Ltd., Coventry, England, with offices at 54 Dey St., New York City, has placed on the market the turret lathe illustrated herewith.

The machine was designed by an Italian and is intended to be operated by men disabled in the late war. The cross-slide, turret and chuck are operated hydraulically by means of cylinders and pistons controlled by conveniently placed valves. A minimum pressure of 75 lb. is required for operation. The drive is by 3-step cone pulley. The turret slide is provided with individual automatic stops.



MORETTI HYDRAULIC TURRET LATHE

Specifications: Swing over bed, 12 in. Bore of chuck, $\frac{7}{8}$ in. Hole through spindle, 1 in. Turret; stroke, 3 in.; diameter, 5 in.; tool holes, 1 in. Range of feeds to cross and turret slides, $\frac{3}{4}$ to 80 in. per min. Floor space, 2 ft. x 5 ft. 8 in. Weight; net 770 lb.; shipping, 1,000 lb. Cu.ft., 60.

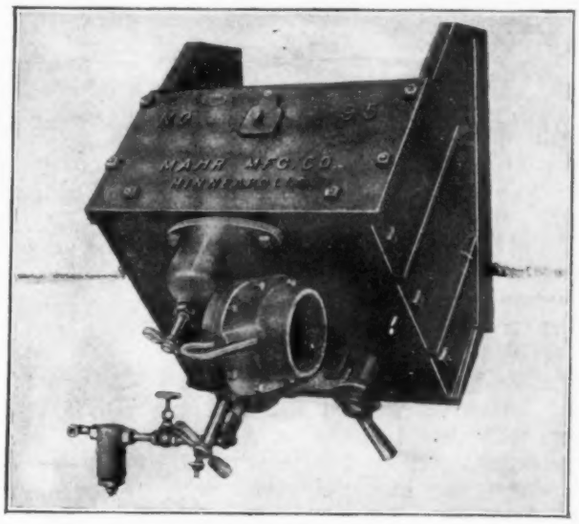
Westinghouse Dry-Type Electric Glue Pot

The Westinghouse Electric and Manufacturing Co., East Pittsburgh, Pa., has placed on the market a two-quart size, electrically heated, dry-type glue pot, of the type illustrated and described in the *American Machinist* of March 20, 1919. The time taken to heat the glue by this type of pot is approximately 15 minutes. Sizes made, 1 pint, 1, 2 and 4 quarts.

WESTINGHOUSE DRY-TYPE ELECTRIC GLUE POT

Mahr Calorizor

This device, built by the Mahr Manufacturing Co., Minneapolis, Minn., is a combination of oil atomizer and gassification and combustion chambers for attachment to industrial furnaces. It is made in the angle and straight types. The former, which is illustrated, is recommended for annealing, plate-heating, and heat-treating furnaces, and for core ovens, while the straight type is for use on drop-forging and hammer furnaces, or for any other high-temperature work where a strong reducing action is required.



MAHR ANGLE-TYPE OIL-FURNACE CALORIZOR

Low-pressure air is used for both atomization and combustion, the pressure being not less than 8 oz. per square inch. The calorizers will handle any grade of oil, or gas can be used by making a slight change in the calorizer. They are built in three sizes, with oil consumption capacities for the straight type of 5, 8 or 12 gal. per hour, and for the angle type of 4, 7 or 10 gal. per hour.

Griscom-Russell Strainer

The Griscom-Russell Co., 90 West St., New York, N. Y., has placed on the market the strainer shown in the accompanying illustration. It is intended for use in straining both oil, as in a lubricating, fuel or quenching oil system, and water, as on a supply line from a river or lake.

The body of the strainer is cast iron and the strainer

GRISCOM-RUSSELL SINGLE-UNIT STRAINER

basket is perforated sheet steel, the basket being lined with wire mesh when the strainer is used on an oil line.

The strainers are made with either screw or flange joints, for pressures up to 300 lb. per sq.in. They are furnished in a range of sizes to fit pipe from 1 to 6 in. diameter, the smallest size weighing 15 lb. and the largest 550 lb.

The strainer may be installed as a single unit or in a set, consisting of two strainers and two three-way valves with the necessary connections. The use of the set permits the cleaning of either of the two units without interruption of the service.

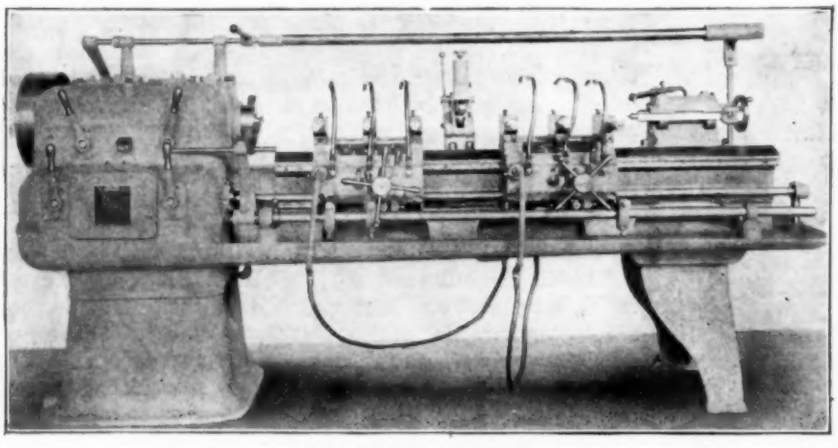
Four-Inch Lo-Swing Lathe

The Fitchburg Machine Co., Fitchburg, Mass., has added to its line the 4-in. Lo-Swing lathe shown in the illustration.

This machine, like the others of its type described in earlier issues of the *American Machinist*, has a constant speed drive and the speeds are controlled by the two upper levers in the headstock, while the feeds are controlled by the two lower levers. With the drive pulley running at 500 r.p.m. six speeds varying from 38 to 316 r.p.m. and nine feeds from 0.007 to 0.120 in. per rev. of the spindle are available. The two carriages, each carrying three tools, run on heavy V's so located that the carriages can be run past the tailstock. The carriage feed gears are driven through Oldham couplings which avoid the necessity of exact alignment. The feed reverse is by sliding gears in the apron. Flexible tubes carry a liberal supply of coolant to the tools and to the tail center.

The shipper rod runs the whole length of the machine and controls a double knuckle-joint clutch in the drive pulley.

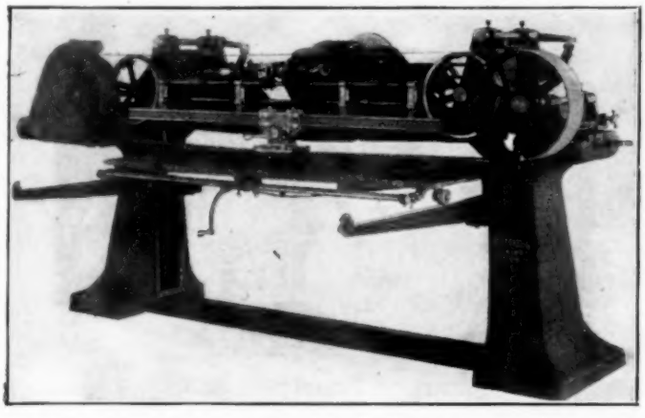
The lathe swings 4-in. in diameter and is made in three lengths to accommodate work up to 60, 80, or 108 in. between centers. The 60-in. lathe requires a floor space of 37½ x 123 inches.



4-IN. LO-SWING LATHE

Mattison No. 124 Automatic-Stroke Belt Sander

The illustration shows the No. 124 automatic-stroke belt sander built by the Mattison Machine Works, Rockford, Ill. Hand-stroking is eliminated by the use of



MATTISON NO. 124 AUTOMATIC-STROKE BELT SANDER

a device which automatically moves the sand-belt across the surface being sanded. The columns of the machine are mounted on a cast-iron base. A heavy casting, on which all of the power-drive mechanism is mounted, extends across the top of the machine, joining the two columns. At each end of the casting, the heads for the sand-belt pulleys are mounted on ways to permit adjustment of the belt tension.

The shoe for applying the sand-belt slides on a bar extending across the front of the machine, and is driven with a rapid reciprocating motion by a steel belt running over two flanged pulleys. The pulley shafts carry pinions that are reciprocated by a pair of geared quadrants, the stroke of which can be varied to suit the length of the work. The levers, pulleys, slide and other parts connected with the shoe,

which is mounted on ball bearings, are made of aluminum.

A lever at the front of the machine enables the operator to control the motion of the shoe. The mechanism is counter-balanced, so that light pressures can be readily applied to the work.

When extra sanding is required in spots on a surface, the sanding shoe may be disengaged from its driving belt and passed back and forth by hand. Two speeds are provided for the sanding shoe, so that when it is working with short strokes the speed may be doubled, which lessens the possibility of its being held too long on one spot.

The work is carried on a light table mounted on ball-bearing rollers. The arms which support the table may be adjusted for height by means of screws located in the columns. Stops are provided to hold the work in position, being adjusted by a lever at the front of the table.

An Invitation to Join the F. A. E. S.

The invitation which follows has been mailed to the engineering and allied technical organizations, asking them to become charter members of the Federated American Engineering Societies:

My dear Sir:

The Joint Conference Committee of the American Society of Civil Engineers, the American Institute of Mining and Metallurgical Engineers, the American Society of Mechanical Engineers, and the American Institute of Electrical Engineers, acting as the *Ad Interim* Committee in accordance with the authorization of the Organizing Conference held in Washington, D. C., June 3-4, 1920, extends to your organization a cordial invitation to became a Charter Member of The Federated American Engineering Societies, and to appoint delegates to the first meeting of the American Engineering Council, of which due notice will be given, to be held in the Fall of this year.

There has been previously sent to you an abstract of the minutes of the Organizing Conference, at which there were in attendance 140 delegates, representing 71 engineering and allied technical organizations. It was the unanimous opinion of the Conference that there should be created an organization

> "to further the public welfare wherever technical knowledge and engineering experience are involved and to consider and act upon matters of common concern in the engineering and allied technical professions"

and that this organization should consist of societies or affiliations, and not of individual members.

On the basis of these fundamentals, the attached Constitution and By-Laws were unanimously adopted by the Conference. These contain full information concerning The Federated American Engineering Societies, the American Engineering Council, its Executive Board, and of the various officers and committees. The basis of representation therein stated for the American Engineering Council is one representative for from 100 to 1,000 members and an additional representative for each 1,000 members or major fraction thereof.

At the gathering in Washington, which was the greatest event in the history of the engineering and allied technical organizations in this country, steps were taken which created "The Federated American Engineering Societies," which will have a far reaching influence on the future of these professions. The fact that this action was taken without a dissenting vote indicates that the psychological moment had arrived and that there was a unanimous desire on the part of the representatives of these professions for the organization formed.

The Joint Conference Committee, the *Ad Interim* Committee, would ask each organization invited to take favorable action in the matter of membership in the organization at the earliest possible moment and to advise the committee promptly of the names of the delegates who will attend the first meeting of the American Engineering Council in November of this year.

The Joint Conference Committee is confident that with the universally acknowledged need for such an organization, there will be a prompt affirmative response to this invitation.

Very truly yours,
JOINT CONFERENCE COMMITTEE
of
American Society of Civil Engineers,
American Institute of Mining and Metallurgical Engineers,
American Society of Mechanical Engineers,
American Institute of Electrical Engineers.

Tapping Acme Threads in Motor Jack Bushings

BY H. W. ARMSTRONG

It was necesasry to tap, per week, about 1,000 bushings as shown in Fig. 1, for our motor jacks, a very difficult operation on which we had four concerns under contract at different times, each of whom, after trying out the proposition, rejected it as being too difficult and unprofitable. Then we undertook making them in our own shop, the taps being furnished by one of the well-known companies specializing in that line. The operation consisted of holding the bushings to be tapped in a lathe chuck which was attached to a drill press, and putting five taps through them in proper order.

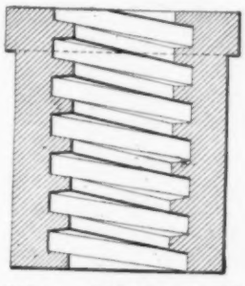


FIG. 1. MOTOR JACK BUSHING

The tap sizes were ¾ in. 4 pitch, ¾ in. 5 pitch, and 1 in. 5 pitch—all Acme thread as illustrated in Fig. 2. We tried these taps and others which we made in our shop and broke so many that we were ready to quit. Our greatest production was seventy-five in nine hours plus two or three broken taps. The taps being expensive and the production very low the cost was prohibitive

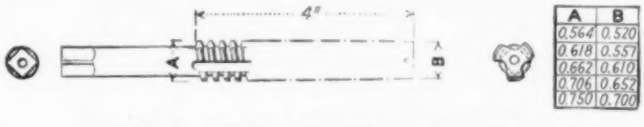


FIG. 2. DESIGN OF TAP FIRST USED

and we had to devise some other means. This we did, making the taps as in Fig. 3, and using only two instead of five.

They were made longer, every tooth filed on the top and sides for clearance, and the taps hardened and drawn to a dark straw, nearly a brown. The workman very seldom breaks one now and production has increased from 75 to 360 in nine hours.

The cost of making a set of the new style taps, two in a set as against five in the old, is much smaller than the cost of the old style taps made outside.

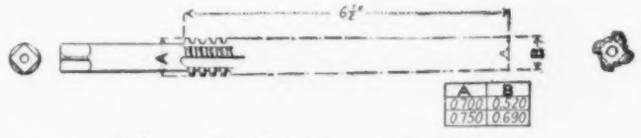


FIG. 3. DESIGN OF IMPROVED TAP

What Other Editors Think

A Billion and a Half More for the Railroads and Every Cent of It Needed.

(From the *New York Sun*)

A BILLION and a half of new railroad revenue at one stroke of the pen fairly staggers the imagination. This is a full quarter of the towering income of the United States Government, which to a large extent still scandalously continues on a war basis. With the existing revenue of the roads it equals the whole income of the Government and more. It surpasses the total wealth of many great nations of the Old World.

But let no man deceive himself with the horseback opinion that this prodigious revenue now given to the carriers as a populous and opulent nation might pour out treasure for war is going to turn a flood of riches into the coffers of the roads and the pockets of the stockholders. Anybody that indulges in such imaginings simply does not know what has happened to the American transportation system generally since the World War came down upon mankind. Perhaps the average person cannot realize what has befallen it in particular since the United States Government on January 1, 1918, took over the operation of the roads. It is not merely a tale of amazing, incomparable spending. It is a tragic history of astounding, fabulous, all but incredible financial wreck and ruin.

Time was, and only just before the war, when $3,000,000,000 of operating revenue covered all the expenses of maintenance of way and all the expenses of maintenance of equipment, provided for all supplies and paid all wages—paid all operating expenses, paid, besides, all taxes, all interest on billions of debt, all dividends on billions of stock, and built up all surplus accounts.

But in the brief interval from the very year before the war—when the total operating expenses, including all wages and all of anything, passed for the first time $2,000,000,000—the railway payrolls alone have shot up into the dizzy realms of approximately $4,000,000,000 a year. This, stupendous though it be, is not all. Coal has gone up by the hundreds of millions. Similarly rails, locomotives, freight cars, passenger cars, all equipment and supplies have gone up. Some costs have merely doubled; some have not stopped when trebled.

Under the avalanche of expenditures which have overwhelmed them the railroads of the United States, the great and powerful as well as the small and weak, have been in desperate straits. Had it not been for the United States Treasury running rivers of the taxpayers' money into their exhausted tills the roads could not, many of them, have met their monthly bills; they could not, more than a few of them, have scraped up their current payrolls; they could not, some of them, have kept on running.

And the plain truth now is that even with this new billion and a half of revenue the roads are not all going to be rich or so much as prosperous. They are going to dig themselves out of their financial drifts only with travail and care. They are going to be strong and sound and effective again only when the blight of that terrible experience has worn itself out, when the workers have come back to their old alacrity, loyalty and efficiency, when wracked roadbeds have been built up again, when overstrained equipment has been restrained, when shattered morale has been revitalized.

So this billion and a half of new revenue, which might seem at first blush to assure adequate and immediate recreation of the carriers in the American substance and the American spirit, is sorely needed, every penny of it. The great bulk of even so vast a sum, in fact, already is swallowed up. It is gone in new wages—the more than $600,000,000 awarded the other day—in new costs of coal, new costs of construction, new costs of maintenance of everything, new costs of all supplies still rolling up.

Not only have dividends been cut or abandoned by the tens of millions, and not only would interest have been defaulted far and wide but for the Government's guaranty which expires at the end of this month. Renewals and repairs have been foregone on much of what was once our most magnificent railroad property. Extensions and betterments have become only a mockery. And withal, there is now, without counting the new wage increase of $600,000,000 a year, and for months there has been, a persistent deficit of hundreds of millions for the bleeding United States Treasury to make up and then take out of the pockets of the national taxpayers. All these tens and hundreds of millions must now be cared for out of the new revenue.

Nobody need expect, therefore nobody who comprehends the gravity of this situation will agree that the American railway system is yet on a clear track, fit at once for perfect service at top speed. But, by the wise and necessary act of Congress and by the heroic measures of the Interstate Commerce Commission in compliance with the new law, the roads in the darkest hour of their existence are saved.

And nobody shall gainsay that it is a colossal transportation bill which the American people are now to pay. But, at that, it will be far cheaper for them than a decaying plant, demoralized organization and collapsing service. The best, the fastest and the safest transportation is a national necessity at any cost.

It is an imperative necessity of the industry of the public, the business of the public and the bread and butter of the country that the American railway system should work right. The country cannot buy right, the country cannot sell right, the country cannot live right unless the railroads are doing their work. And under private management, with income enough to pay their way, they can. They must; they will.

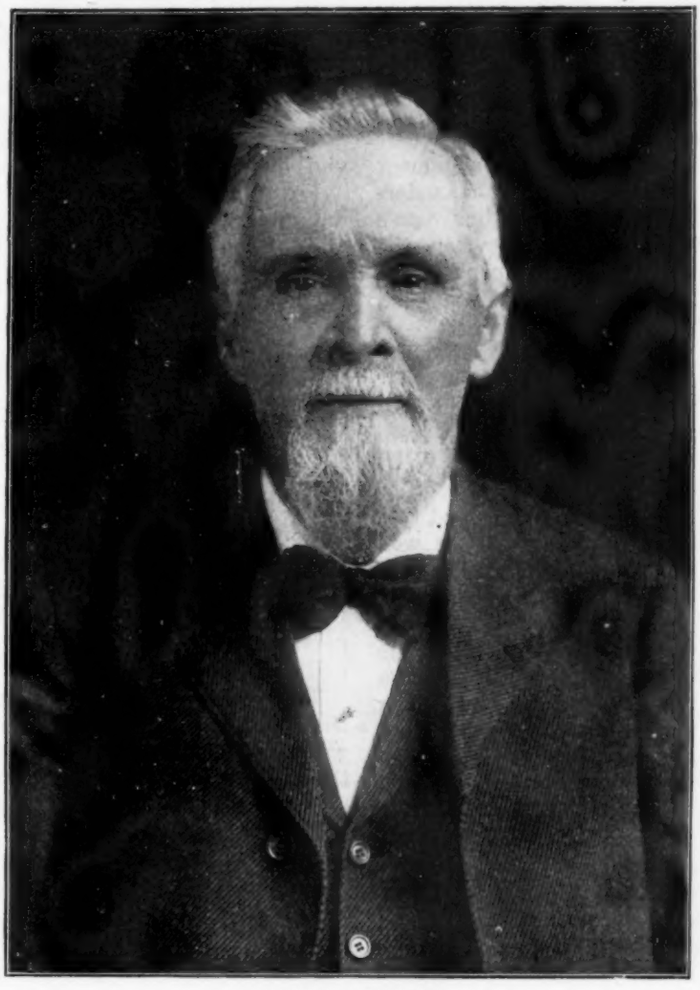
If we can get the roads back to doing their work and if the roads can get the men, so utterly demoralized during Government operation, back to their old time efficiency the American public's transportation bill may fall again—some day, not soon. The damage which has been done is too deep to be repaired for a long time.

Amos Whitney

AMOS WHITNEY died at the Poland Springs House, Poland Springs, Me., August 5, after an illness which had lasted about four weeks. He was 88 years old.

Mr. Whitney came from distinguished Colonial and English ancestry. Whitne-on-the-Wye, from which the family takes its name, is mentioned in the Doomsday Book. One Sir Randolph Whitney accompanied Richard Coeur de Leon to the Holy Land and was there victorious in a single-handed combat with three Saracens—one of them a brother of Saladin.

One of Sir Randolph's descendants came to America in 1635 and was known to the Plymouth colonists as John Whitney. In this country the family has continuously held a prominent and substantial place—many of its members showing decided mechanical tastes, as Eli Whitney, inventor of the cotton gin, Baxter D. Whitney, the Winchendon machine builder, and—Amos Whitney.



AMOS WHITNEY

Although the name of Amos Whitney is inseparably connected with the city of Hartford, Conn., and the Pratt & Whitney Co., he was born in Biddeford, Me., on Oct. 8, 1832. Moving to Lawrence, Mass., he was apprenticed at the age of fourteen to the well-known Essex Machine Co. of that city, going to Hartford in 1852, at the age of twenty. There he was employed at Colt's Armory, at that time the Mecca of many New England mechanics, where he met Francis A. Pratt and Asa S. Cook. Pratt left shortly afterward to take charge of the Phœnix Iron Works (now the Taylor & Fennl Machine Co.), run by Levi Lincoln and his two sons, George S and Charles L. Mr. Cook in 1853 also went to the Phœnix works, as a contractor, taking young Whitney with him, in spite of his youth, as a full partner. This took something of a struggle on Whitney's part as he was making $8 a day at Colt's and the new job offered only $2 at the beginning. But the future looked promising and he made the change.

As many of the present generation have never seen a contract shop, it may be well to explain that the firm furnished materials, machinery, tools, and shop-room supplies, while the men were directly employed by the contractor. Wages, however, were usually paid by the firm and charged against the contractor's account. At the Phœnix Iron Works Pratt designed the "Lincoln" lathes, the "Lincoln" milling machines and other products of the Phœnix plant. Whether the idea of the milling machine came originally from Windsor, Vt., as some claim, or originated in Hartford, is difficult to prove at this time—but at any rate the machine is known as the Lincoln milling machine all over the globe.

Pratt & Whitney each recognized the ability of the other and they became closely associated. The same ambition which urged Whitney to go to Colt's Armory and later to the Phœnix works, drove him into business for himself, with Pratt. While still at the Phœnix, they formed the Pratt & Whitney Co., hiring a room 40 ft. square nearby and employing two men. There they began manufacturing in 1860. They made a little machine for winding thread known as a spooler. The business grew, soon requiring ten men and outgrowing the original quarters. The next shop was in the Wood Building, which has been the early home of several successful concerns, so that there is a feeling around Hartford that any business starting in the Wood Building is bound to be successful. In the little shop John Johnson, Mr. Whitney's father-in-law, acted as pattern maker, millwright, bookkeeper and handy man generally.

A few years later Pratt & Whitney moved into their own building, the old shop having been destroyed by fire. The first structure of their new plant was built in 1865. The firm was known as the Pratt & Whitney Co., and was incorporated in 1869, with a capital of $350,000. At first the upper floor was leased to the Weed Sewing Machine Co., but after a short time the whole building was needed and the Weed company moved across the river (known as the Hog River by the unregenerate) to what was later part of the plant of the Pope Manufacturing Co. The capital stock was increased, in 1875 to $500,000 and in 1893 to $3,000,000. There has been a constant rapid growth since. In 1893 Mr. Whitney was made vice president. Later he was made president, in which office he continued until January, 1901, when the control of the company was acquired by the Niles-Bement-Pond Company. Mr. Whitney remained as one of the directors. At the time of his death he was president of the Gray Telephone Pay Station Co. and treasurer of the Whitney Manufacturing Co., organized by his son Clarence.

The contract system was in vogue at the Pratt &

Whitney plant, but Mr. Whitney, in addition to being general superintendent, always had a good sized force working directly under him on work that did not lend itself to the contract system. Although he was a strict disciplinarian, tolerating nothing irregular or inferior, on account of his own innate *fairness*, it was the ambition of everyone to work for "Whit" as he was called in loving abreviation.

Everybody has a hobby, and Amos Whitney's hobby (so far as the product of the shop was concerned) was "round corners." Even when the works had grown to employ several hundred men, he always had in his pocket a smooth file with which he would "round over" any sharp corner that did not suit his fancy on any machine in process of making. This hobby was so marked that when he got ready to build his house, everyone said the house would have round corners—but it didn't.

He was a noted machine-tool salesman, and a pioneer in the methods which are now beginning to be understood as correct. He never belittled the other man's machine, never recommended his machine when the other man's machine was better for the purpose and would cheerfully recommend the machine that was best, never asking "What is there in it for me?"

His unbounded optimism was well displayed when the Pratt & Whitney Co. went through its first panic. It kept right on making standard machine tools, but selling almost nothing, until all the available storage room was filled. Then a large space was hired from the Weed Sewing Machine Co. and when this was filled another large space was hired in Colt's "West Armory" and this in turn was filled with finished machinery. It is well to note, as a matter of history and as a suggestion for the future, that when this immense stock began to move it was practically sold out in 30 days.

Mr. Whitney was very fond of horses—though he later said he was glad that he had lived to see the automobile—and the knowing ones who wanted a day off when the shop was busy, always, when possible, timed their requests for absence to agree with the days when there was horse racing.

He was always an early bird, usually the first to reach the shop in the morning, in consequence of which there were few tardy workmen.

It should also be remembered that Mr. Whitney took an important part in the development, in this country, of standard measuring instruments, one of the first moves being a determined effort to secure a standard inch block. His company purchased at considerable expense a standard rectangular bar, 1 in. square and 12 in. long, which had been used as a standard of measurement. Twelve 1-in. cubes were then made as accurately as possible and tested by the 12-in. piece. It was found that the twelve 1-in. cubes were not as long as the single bar, supposed to be exactly 12 in. long. Careful measuring and comparison with such standard instruments as were available led the company to believe that the individual inch-blocks were more nearly accurate than the longer piece, and this was afterward proved by the Rogers-Bond comparator, which was developed in the Pratt & Whitney works.

At that time no one realized the effect of comparatively small changes of temperature on steel, which led to numerous interesting and embarassing situations. Nor was it understood that a plug and ring gage might be put together and prove to be a nice fit if relative motion were maintained, but seize if allowed to remain stationary. The gages exhibited by the Pratt & Whitney Co. at the Centennial Exposition ran up to about 2 in. in diameter. To avoid leaving the hole "bell-mouthed," the ring gages were made with a slight projection on each end, which was afterward ground off. No one understood the effect of aging on steels or the changes that would take place after hardening and Mr. Whitney's own story of his experience with these Centennial gages is of interest. They were finished several weeks before the exposition and all completely tested before laying aside to await shipment. Just before sending them to Philadelphia he picked up a ring and plug gage to make sure it was right but could not make the plug enter. Every plug proved to be large and the gages had to be refinished before sending.

All his life Mr. Whitney was doing something for some one else, but he disclaimed any credit for this, saying "I believe that every dollar I give to help some one who needs it more than I do, will come back."

Mr. Whitney leaves a son, Clarence E. Whitney; a daughter, Nettie L. Whitney; a brother, Major George Q. Whitney of Hartford, and two sisters, Mrs. George H. Carey of New York, and Miss Fannie Whitney of West Newton, Mass.

The Evolution of the Engine Lathe

BY L. L. THWING

In Mr. Franzen's interesting article on engine lathes, on page 184 of the *American Machinist*, an explanation of the derivation of the term is given by associating the development of the lathe with that of the steam engine, suggesting that, since lathes were driven by engines, they were called engine lathes. While it is quite possible that this is true, there are several pertinent facts touching on this question, that are entitled to consideration.

The term "engine lathe" is certainly not as old as the general use of the steam engine. Steam engines were in common use during the Civil War period, and the engine lathes were not, as can be readily verified by an examination of the text and advertising of the trade papers of that period.

"Engine" is not the word applied to power-driven machinery; "steam" is the word. For example, the Naumkeag Steam Cotton Mill at Salem, and the use of the expression "steam looms" by many mill men of English birth.

The word "engine" was formerly used in apparently the same sense as "machine," as, for example, gear-cutting engine, carding engine, rose-turning engine, and even screw-cutting engine.

In Byrnes' Mechanical Dictionary, published by D. Appleton & Co. in 1851, will be found the following in Vol. 1, page 168:

"Lathe, Engine, Figs. 2,511-13.

Fig. 2,511 is a side elevation of the *engine*.

Fig. 2,512 is an end elevation.

Fig. 2,513 is a side elevation of the tailstock."

It will be noted that the word "engine" is used in the same sense as headstock.

Some years ago there appeared in the *American Machinist* an article on old machine tools, which reproduced the manufacturer's advertising circulars, and in these the small lathes were designated as either screw-cutting lathes, or turning lathes, and the large ones as engine lathes.

Business Conditions in England

FROM OUR LONDON CORRESPONDENT

LONDON, July 23, 1920.

THE decision of the Industrial Court against the demand by engineering workpeople for an increase in wage rates will to some extent mitigate commercial difficulties being experienced by machine-tool and other engineering firms in Great Britain who attempt to enter into large contracts for the European continent. Here, as compared in particular with his American competitor, the British manufacturer has been badly handicapped, being unable without serious risk to quote fixed prices for anything outside immediate delivery owing to uncertainties as to the costs of labor and material. Customers in Great Britain of firms who have quoted subject to prevailing conditions at the time of delivery have been irritated to find varying estimates as to increased cost caused by admitted increases in wages of labor and prices of materials. Continental firms have refused to accept delivery, though here the exchange variations have really been the determining cause. At least one heavy-machine-tool firm has therefore quoted what is in effect maximum and minimum prices, stating frankly the increase estimated, and agreeing that the actual price charged should be based on prices at the date of offer, plus a percentage to vary with increase of costs, etc., but in no case to exceed a given amount. In this they did but follow the practice of some electrical firms.

CLAIMS OF WORKPEOPLE

The claim for an increase of 6d. an hour was put forward on the grounds of increased cost of living and of greater wage advances in other trades, and with the view that the general condition of trade justified the increase. On the other hand, the employers, according to the official statement, submitted that advances already made covered the increase in cost of living "and that the commercial position was such that a further advance in wages would be accompanied by grave risks of injury to the engineering trade." The court stated that published returns indicate good employment, but that the employers' evidence showed that "there are already indications in some branches of the industry of a falling off in demand." Accordingly it held that the claims submitted were not established. Whether this decision will meet with general acquiscence on the part of engineering workmen remains to be seen. Meetings are being held throughout the country to consider the matter. Further, the economic effect of the 47-hour week and other problems of engineering employment have been discussed in private conferences between representatives of employers and employed. While agreement may be reached on other matters, the employers' representatives adjourning to consult the federations, the trade unionists remain firm against payment by results.

IRON AND STEEL MARKET REPORTS

From the London iron and steel market reports are a little contradictory; that is to say, decline in prices and in orders offered is shown on the semi-finished side, where as regards pig iron prices remain firm. Larger quantities of American material in a semi-finished state have, it is understood, lately been on offer. On the finished-steel side the demand has lessened and the supply. apparently, increased.

Of the various branches of engineering little that is fresh can be said, but unemployment is being more freely reported from midland towns associated with automobile and cycle industries and from heavier engineering centres farther north. Would-be customers of one or two motor-car firms have had an unpleasant experience for, having paid their deposits, they have learned that the firms concerned have been compelled to close down without delivering the cars. In some cases, apparently debenture holders have prior claim.

That the United Kingdom is regaining its shipbuilding pre-eminence seems to be plainly suggested by figures just published here based on the returns of Lloyd's register. According to this merchant ships building here on June 30 last totalled 3,578,000 tons, the total tonnage being built abroad at the same date being 4,142,000 tons, this not including, however, Germany, as figures are not available. As to the United Kingdom an advance on the quarter is shown, while for the rest of the world a decline was exhibited, a decline which was specially marked in the case of the United States the fall here in the three months being given as 467,000 tons. Japanese figures, too, show a decrease, but increases are indicated both in Holland and in the British dominions. The tonnage now building in the United Kingdom is in fact almost double that at the corresponding period of 1914, but how far recent cancellations of orders have had effect is not clear. At the same time the tonnage building abroad has considerably more than doubled, comparing with 1,441,000 tons in June, 1914.

BRITISH ENGINEERING STANDARDS ASSOCIATION DOING GOOD WORK

The British Engineering Standards Association is continuing its good work and the average British reader of this journal is anticipating with interest the impending publication of the new report on milling cutters and reamers, said to be one of the most comprehensive prepared. During the past twelve months twenty-seven standard specifications have been issued, a further seventy being under revision. In the electrical industry forty-five specifications are in course of preparation, and the work in connection with ship-construction details and marine engineering is reported to be making good progress. Despite the fact that a large amount of this work is done freely by members (for there are some 300 committees on which the report states sit more than 1,400 men), yet on the year's working there is a deficit of £1,100. An appeal is therefore being made to British engineers so that the £15,000 to £20,000 a year needed to carry on this work may be assured.

A British Empire exhibition will, as announced, be held in London in 1923, one of the objects being "to demonstrate the natural resources of the territories of the empire and the inventive and manufacturing energy of its peoples." The government will probably guarantee £100,000 toward its promotion. This will be granted, however, on the understanding: (1) That an additional sum of £500,000 is secured from other sources; (2) the Board of Trade shall have the right to approve the choice of a general manager of the exhibition and shall be officially represented on the executive council, of whose proper constitution they shall be satisfied; (3) all regulations in connection with the exhibition, such as those affecting the participation of the various parts of the empire and the entry of British exhibitors, shall be subject to the approval of the Board of Trade.

A committee is being appointed by the Board of Trade to consider the policy to be adopted in connection with trade fairs, more particularly as regards districts in which the exhibitions are to be held, trades to be included, and the class of exhibitor to take part. In thus fostering trade exhibitions, etc., the board are but pursuing and improving on a policy they followed for a number of years before the war.

TECHNICAL INSTITUTIONS HAVE RESUMED PRE-WAR PRACTICE

The technical institutions centered in London have resumed their pre-war practice of holding summer meetings in the provinces. Thus the Institution of Electrical Engineers journeyed through parts of the west of England and South Wales, although apparently only 160 persons took part, several of these being ladies. The success therefore is to be regarded as modified. Then the Automobile Engineers went on a week's journey through Sheffield, Derby and

Manchester. Now the Institution of Mechanical Engineers has just been holding its summer meeting in Lincoln, about 190 members, plus 60 ladies, attending. Beside visits to local works this institution has been hearing a number of papers on such subjects as the uniflow steam engine, recent excavator practice, Lincolnshire oil engines, transport by steam vehicles, and the human factor in industry. Other institutions have rather tended to drop the formal reading and discussion of papers during summer excursions.

Olympia Machine-Tool Exhibition

The Machine Tool Exhibition to be held in Olympia, London, W., during September will be preceded by a banquet on Sept. 3.

Under the directorship of Sir J. E. Petavel the National Physical Laboratory, Teddington, appears to be rather less averse from publicity than has been the case in the past and recently the metrology section was thrown open for inspection, engineers and others interested from all parts of southern and midland England responding to the invitations. Of one interesting matter no particulars could be obtained. It is the method developed by A. J. C. Brookes following a suggestion by J. E. Sears, the superintendent of this department, for producing slip gages of the Johansson type which can be "made commercially to an accuracy of one part in a million on all sizes down to 1 in. and uniformly of 0.000001 in. on smaller sizes." A standard on gage being given all smaller sizes can be generated with the "accuracy of one part in a million or one-millionth of an inch." It is understood that a paper on the subject is in preparation and will be read before one of the London technical institution in due course.

Two Comparators for Slip Gages

The exhibits included, by the way, two comparators for slip gages, both designed and made at the laboratory, and capable of detecting one-millionth of an inch. The simpler machine has ball-point faces and measures by local contact only. The other machine has flat faces with special adjustments, and comparisons between slip gages, cylindrical plugs and balls up to 4 in. can be made by it. In the design the elastic strain of the machine itself is recorded, optical indicators being employed.

Another matter of gaging interest in the workshop related to plugs and sockets. As gages for holes, balls have their recognized defects, as of course there is no axial direction about them in comparison with the ordinary cylindrical plug. Again, it is now being generally recognized that they exert a powerful wedging action on the ring, so that a relatively large ball can readily be passed through a relatively small hole. Further, balls are held on handles screwed in and the action of fastening the handle to the ball itself distorts the ball. The fact that expansion is possible with ordinary socket gages was shown very plainly, for a plug known to be larger than the bore of the ring was pushed in by hand, and the difference in outer diameter of the ring before and after was clearly indicated on a minimeter. The laboratory now has a new gage workshop, especially equipped with precision machine tools, English and American, and only just brought into operation. It is in this department that the slip gage process is being developed.

The Manchester Center

Although of late years Manchester as an engineering area may not have expanded as much as its admirers would desire, yet this is hardly true of the Broadheath district, some half a dozen miles or so from the center. Here years ago the George Richards firm found its home and, after some changes of practice, settled down to the production of machine tools, of late more particularly in the form of vertical boring and turning mills, side planers, and surfacing, boring, milling, etc., machines. Opposite them is Luke & Spencer, Ltd., connected with abrasive wheels and certain kinds of grinding machines. The Linotype Co.'s factory, too, has long been a prominent feature of the landscape and Meldrums, Ltd., built a new works at Timperley, near by; while more recently the steam and other gage works of Schaffer & Budenberg were removed here. An addition to the purely machine-tool firms was made when H. W. Kearns & Co., Ltd., also a maker of universal milling, boring and surfacing machines, erected its shops not far from the Richards' buildings. Later still, comparatively near, Smith & Coventry, Ltd., built works for its small-tool section, leaving the machine-tool side in sole occupation of the Salford factory. Omitting from the account minor engineering firms, within the last few months a still larger addition has been made by the Churchill Machine Tool Co., Ltd., which has erected works, now fully occupied, for the production of precision grinding machinery of all kinds. It forms in fact easily the largest concern of this type in Great Britain. Under the control of H. H. Ashbridge, the new works on a single floor covers a space approaching three acres, while much land is available for extensions, some of which is already under way. The small-tool department is just in the finishing stages of building. In short it is concluded that this year will see the whole of the works removed from Pendleton to the Broadheath site. The general manager, S. H. March, is of course well known on your side. The Churchill firm is next door to H. W. Kearns & Co., which again as a neighbor on two sides has George Richards & Co., whose latest foundry is being erected with two light and two heavy bays for a monthly output of about 350 tons.

The Openshaw District of Manchester

Then in the Openshaw district of Manchester, where the Whitworth firm (now Armstrong, Whitworth & Co., Ltd.) always had its center, shops that until recently were devoted solely to war purposes have been converted to machine-tool and small-tool production. We have referred to the small-tool factory organized in what was a shell factory.

Now in the shops formerly devoted to the production of howitzers and relatively light field guns the firm has organized a special machine-tool side, which will, for the present at any rate, be mainly concerned with the production of tools for locomotive and railway shops in general and for shipyard work. It is under the direction of C. D. Andrew, with whom is associated J. Cullimore, both of whom were formerly with the Niles-Bement-Pond organization in Great Britain. Apart from offices the machine-tool works have a floor space of about 130,000 sq.ft. The two-story building used as offices measures 120 x 40 ft., and includes a top-floor drawing office, 100 ft. by the full width, and offices for general and works management and for the estimating, progress, planning and outside supply departments.

Markets have of late been found for the productions of this department in France, Belgium and India, as well, of course, as in Great Britain, including the firm's own works in the Newcastle district. Productions in hand include wheel and wheel center lathes, axle lathes, quartering machines, vertical boring and turning mills, railway-tire drilling and tapping machines, punching machines, planers, radial drills, surface grinding machines, screwing machines, etc. In each case the design is new. Before the end of the year, too, the Victor semi-automatic machine will be placed on the market after redesigning.

Birmingham Small Arms Co. Branching Out

The Birmingham Small Arms Co. is branching out in various ways and its efforts in connection with small tools has already been noted in these columns. In Birmingham it has a series of works, each devoted to a particular purpose, and it has partly built and partly under construction two new works on the Coventry Road, Birmingham, one of which will be used for machine production. Both works are of ferro-concrete construction, but the methods of building differ. In the one case the ordinary system of casting in molds in position on the site is being employed, while in the other case the columns, roof principals, etc., were cast separately and then erected just as if they were of steel, pockets being left in the foundations for the feet of the columns, which were grouted in, the trusses being brought by rail and hoisted into position, etc. The full width of the shop was worked and the roof put on as quickly as possible, so that one end of the shop was in use before the other end was finished.

This building is about 200 x 640 ft., in 20-ft. square bays, and the principals were designed to carry a concentrated load of 2 tons. To prevent freezing of the concrete during the setting (the work being undertaken in winter) the molds employed for the trusses, etc., were heated by steam coils connected by insulated pipes to the boilers some distance away.

The other building now under construction is cast one floor at a time, the necessary molds being erected by traveling cranes running on light rails on the floors being cast. In this way has been completed one of six buildings, all alike, providing a total floor space exceeding 2,000,000 sq.ft. Each unit is built around a courtyard measuring 100 x 200 ft.

Firms Increasing Capital

Thomas Robinson & Sons, Ltd., Rochdale, is the latest engineering firm to appeal to the public for capital. As part of an authorized share capital of £450,000 it is issuing at par 125,000 7½ per cent cumulative preference shares of £1 each and 25,000 ordinary shares of £1 each. Debentures to the extent of £60,000 at 5½ per cent redeemable on Jan. 1 next have been issued. The business was founded in 1838 and in addition to works at Rochdale and offices in London a branch office and works have been established in Sydney, Australia. Profits have been mentioned as follows:

For 1915, £17,668; for 1916, £26,444; for 1917, £19,-528; for 1918, £29,635; for 1919, £38,236. The business carried on is mainly the manufacture of woodworking machinery and of flour-milling and grain-cleaning machinery. Deducting debentures, loans, sundry creditors, etc., the net assets are valued at £226,577, this including land, buildings, machinery, tools, patterns, etc., at £111,589, and stocks at home and abroad valued at £195,809.

Armstrong, Whitworth & Co., Ltd., with a total authorized share capital of £11,012,500, of which £10,012,500 has been issued, and £2,500,000 4 per cent mortgage debenture stock issued has been making an issue of £2,000,000 in second mortgage debenture stock at 95 per cent. carrying interest at 6½ per cent and redeemable on or before Jan. 1, 1946. The underwriters, it is gathered, were left with about 72 per cent of the issue. On the other hand, its rivals, Vickers, Ltd., which has a total authorized share capital of £26,-500,000, of which £20,679,040 has been issued with 4 per cent first mortgage debenture stock outstanding of £1,250,-000, have just had fully subscribed the issue of £1,500,000 7 per cent 7-year notes at 95 per cent repayable at par on July 1, 1927.

How Can We Increase Production?

By George Sydney Binckley

You say you want increased production. Very well. How are you going to get it? We may as well face certain brutal facts. As to your idealism, forget it, for it won't increase production. It isn't what you think men *should* do that is important—it is what they *will* do that counts.

You want increased production. You won't get it by asking it of your men as a duty to mankind in general. Try this argument on your tailor. Try it on the hatter who charges you four prices for a hat. Try it on your men, and they will reason thus: "I have a job, my labor is in demand, and this demand will grow less insistent and profitable to me in proportion to my increased production. Why should *I* speed production?" Try it on some one who controls his market. He will reason to himself thus: "The high price of my goods is due to heavy demand and limited supply. My profits originate in this condition. Why should *I* speed production?

Of course they oughtn't to reason this way—but they do. What are you going to do about it?

The employers of labor have surrendered economic leadership to the trades unions. If things are to be improved—indeed if industrial disaster is to be avoided—this leadership must be *regained* and *wisely used*.

There are three ways by which you can get a man to do what you want him to:

First: If you have the arbitrary power to do so, you may force him to do your will.

Second: You may appeal to his sense of duty or his patriotism.

Third: You may make it worth his while.

The first of these methods is the favorite, but carries the distinct disadvantage that if the position is reversed, you are rather more than less likely to get rough treatment in your turn.

The second is uncertain, erratic and never permanent in its results.

The third is infallible.

This may seem a harsh judgment of human nature, but has the advantage of being the bald truth.

Paying for Service

If you want service from a man, make it worth his while to render it—and you'll get it. If you want to prevent labor turn-over, make the job valuable to the man who holds it. If you want efficiency in field or factory, *pay the efficient men a high wage and fire the dubs.*

If you have a lathe hand who turns out twice as much work per day, in quantity or quality, as the next man, and this next man is worth his wage, don't throw your star man a sop of twenty-five or fifty cents per day more—*pay him what he earns. You get the work—pay for it.* If you do this, *one* of these men will value his job, will boost the factory, and will swear by his boss—and *he* is the man you want to hold.

You want to speed up production: You will never be able to do it by collective bargaining. If you want speed, pick out the men *who can* speed production, *and pay them to do it.* Pay the others what they earn—*no more* and *no less.* If they don't like it, let them go—your policy will promptly fill your factory with the cream of the workers—let the other fellow take the dregs.

Co-operative Individualism

What is needed to speed up production, to avoid labor turnover, and to put industry on a sound basis of efficiency can be summed up in two words—Co-operative Individualism. This simply means the square deal—but the square deal *all round.* It means that a man should be encouraged to do his best by being paid for doing it. It means that the development of individual talent, initiative and ambition cannot be dispensed with in the development and maintenance of industry.

And Co-operative Individualism means the *open shop.* The whole spirit of the closed shop is against individual development, against ambition and against efficiency. As an institution it has convicted itself, and its rules and practices are more directly responsible for underproduction than any other single factor.

Do you want increased production? Then pay for what you get—whether it be the brawn and muscle of the willing laborer, or the brains and ability of an executive.

Do you want a man to work harder? Then make it worth his while and he'll do it.

Otherwise he won't.

Cincinnati Milling Machine Co. Outing

Although there is supposedly a machinist strike on in Cincinnati, no evidence of it is seen at the plants of the Cincinnati Milling Machine Co. and the Modern Foundry Co. who found the opportunity for having a "birthday party." The outing was held at the Cincinnati Zoological Garden on Saturday, Aug. 7, the entire day being filled by a varied program of stunts.

The morning was occupied by entertainment for the women and children, chiefly, a "better babies contest" being the principal feature. The afternoon was enlivened by contests and games of all descriptions. The thing that was particularly pleasing to the employees was that for the first time on record "Lil," the Zoo elephant, was defeated in a tug of war, the foundry huskies being more than a match for her. Music, singing, dancing and fireworks closed a very enjoyable day, the employees' chief regret being that birthdays do not come oftener.

The success of the outing was due largely to the efforts of the committee, with Otto P. Geier as chairman, although the committee was loyally supported by the whole force of the shop. Fred A. Geier, president of the Cincinnati Milling Machine Co. and of the Modern Foundry, who gave the party, received hearty congratulations from his employees and their families. Good fellowship and plant morale were certainly promoted by the party.

Oxweld Co. Moves Export Department to New York

The export department of the Oxweld Acetylene Co., which was formerly located at the company's factory in Newark, N. J., has been removed to the Carbide and Carbon Building, 30 East 42nd St., New York. The department has been reorganized and is now under the direction of R. G. Noble, who will co-operate with the general sales department of the company.

Oxweld equipment is being exported extensively to Cuba and practically every South American country, as well as to Australia, Central America, Hawaiian Islands, South Africa, China, Japan, and even Russia. In many of the large mine, shipbuilding and railroad shops in these countries Oxweld apparatus is standard equipment. In Cuba a large number of the sugar mills have installed complete welding and cutting departments, revolutionizing the repair and upkeep of the heavy machinery used in this work.

Recent reports show that in several instances the entire cost of the Oxweld welding and cutting equipment has been more than paid for through its use in a single instance by keeping the plant running and avoiding costly shut-downs which would have occurred had there been no such installation at the factory.

Millers Falls Co. Adds Hacksaws to Its Large Line of Tools

The Millers Falls Co. has purchased the plant of the West Haven Manufacturing Co. at West Haven, Conn., which for twenty years has been engaged in the manufacture of Universal and other brands of hacksaws, bandsaws and small tools.

The acquisition of this fully equipped plant, which has been making a blade of highest grade for many years, furnishes a firm foundation upon which Millers Falls may build. It enables the Millers Falls Co. to underwrite the quality, design and policies of distribution of this factory's full output. It meets the company's desire to add hacksaws to its line, having been the originators of hacksaw frames and power hacksaw machines. It affords an opportunity for enlarging its capacity—a need that has been urgently increasing in the steady development and growth of the company's business.

Not only will the Millers Falls Co. continue the manufacture of Universal saws but it will also make at its West Haven plant a complete line of both hand and power hacksaws under the "Millers Falls" brand.

The Millers Falls Co. will be operated hereafter through its plant at Millers Falls, its plant at Brattleboro, Vermont, and its new plant at West Haven, Conn.

Robert F. Whitehead Appointed Commissioner of Patents

Recess appointments made by the President on Aug. 9 designated Robert F. Whitehead as commissioner of patents and Melvin H. Coulston as first assistant commissioner. They will take office at once.

Both Mr. Whitehead and Mr. Coulston have been members of the Patent Office staff for more than eighteen years. Each has worked his way up through the various grades of examiner.

Mr. Whitehead is a Virginian and a graduate of the University of Virginia law school. Mr. Coulston is a native of New York and received his legal training at Cornell.

Board Considers Wage Increase for Navy Yard Employees

The Navy Wage Board began hearings Aug. 5 in the matter of wage increases at the various Navy Yards. Over 200 representatives of the various trades employed at the Navy Yards throughout the county were in attendance. The increases requested are from 20 to 40 per cent. Assistant Secretary Roosevelt, who looked in on the meeting, called attention to that fact that wages must be paid from fixed appropriations, so that any increases in wages mean decreases in the number of employees.

Not later than Aug. 20 the Navy Wage Board expects to place in the hands of the Secretary of the Navy its recommendation with regard to wage increases asked by the employees in the various trades at the Navy Yard. The machinists made a general proposal that their wage be increased to $1.25 per hour. J. F. Anderson was the chief spokesman for the machinists.

The demands for increased pay were made in spite of the knowledge that any increases can be met only by reducing the number of employees. Since appropriations are fixed by Congress the immediate result of wage increase will mean the release of enough men to allow the payment of the remaining employees at the higher rate.

The master mechanics ask for a flat rate of $16 per day. H. T. Morningstar of the Washington Navy Yard was the chief spokesman for the master mechanics of all navy yards.

Charles L. Deane, expert in the experimental and research department of the Greenfield Tap & Die Corporation, Greenfield, Mass., died July 13 as the result of an automobile accident two days previous, when his car went over a steep embankment at Colrain. Mr. Deane, who was fifty-nine years old, had been with the G. T. D. since his youth.

The Chicago Machinery Dealers' Association has formed a teaming and machinery-moving corporation to meet the conditions imposed by the strike of machinery movers and teaming contractors. Machinery is moving in Chicago now after having been tied up for three weeks. It is predicted that many economies will be effected by the new teaming contracting concern for both machinery dealers and machinery manufacturers' branch houses; also enabling the teaming company to pay more than the union scale not inclusive of an employees' profit-sharing plan.

LD'S INDUSTRIAL FORGE
News Editor

Ten Ways To Kill a Branch of an Engineering Society

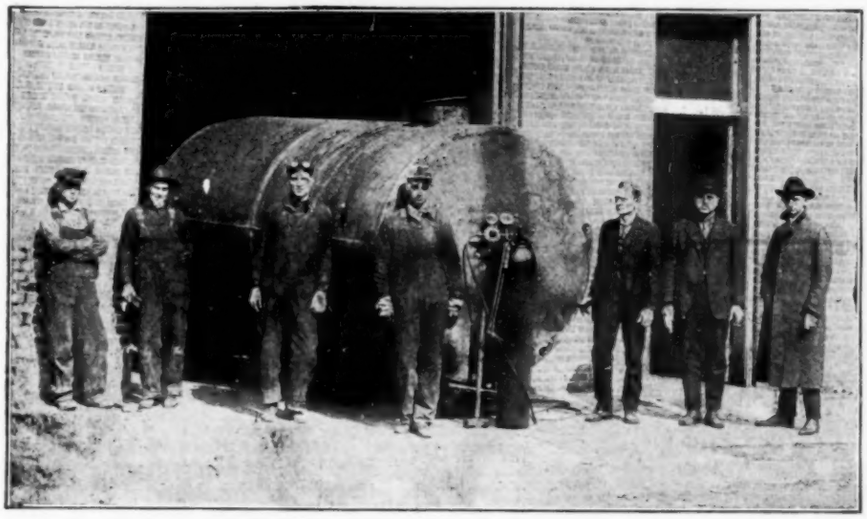
(1) Don't come to the meetings. (2) If you do come come late. (3) If the weather doesn't suit you, don't think of coming. (4) If you do attend a meeting find fault with the work of the officers and other members. (5) Never accept office, as it is easier to criticise than to do things. (6) Nevertheless, get sore if you are not appointed on the committee, but if you are do not attend committee meetings. (7) If asked by the chairman to give your opinion on some matter tell him you have nothing to say. After the meeting tell everyone how things ought to be done. (8) Do nothing more than is absolutely necessary, but when members roll up their sleeves and willingly, unselfishly use their ability to help matters along howl that the branch is run by a clique. (9) Hold back your dues as long as possible, or don't pay at all. (10) Don't bother about getting new members. "Let George do it."—The Engineering Institute of Canada.

Individualism is a fine thing for initiative, but co-operation is necessary for progress.

Uehling Instrument Co. To Exhibit Latest Products

In view of the present great scarcity of fuel and the unusual public interest in the economical consumption of it the Uehling Instrument Co., 71 Broadway, New York, has decided to exhibit its fuel-saving devices at two of the leading expositions of the year; namely, the Chemical Show, Grand Central Palace, New York, on Sept. 20 to 25, and the National Association of Stationary Engineers' Convention, Milwaukee, Wis., on Sept. 13 to 17.

The principal products to be displayed will be the new "Style U" CO_2 recording equipment. This instrument keeps tabs continuously on the largest item of waste in the boiler room; namely, the heat discharged up the chimney, thus enabling the operators to make adjustments that will reduce this loss to the minimum. A gage on the front of each boiler serves as a working guide for the firemen and a recorder in the office of the engineer or superintendent simultaneously makes a permanent record of the performance of each boiler furnace. Other boiler room instruments, including Uehling pyrometers and draft gages, will also be exhibited.



WELDED ASPHALT TANK FOR ROAD WORK

An interesting job recently turned out by the Chattanooga Brazing and Welding Co., Chattanooga, Tenn., is the welded asphalt tank, about 14 ft. long and 6 ft. diameter, shown in the illustration. The tank holds 2,500 gal., and is made of $\frac{3}{16}$-in. steel plate. The shell is composed of four sheets welded together at the circumferential and longitudinal seams; the heads are welded in, and altogether there are about 85 lin.ft. of oxyacetylene welding besides the welds in two pipe racks inside, which support 500 ft. of steam coils. The heads are braced with 2-in. angle irons welded in. The manhole dome, 15 in. diameter, is welded on, and there are nine welded pipe fittings in the steam coils.

Two men built the tank complete in 131 hr., including rolling, drilling, shaping the braces, making studs, tapping holes, riveting, making the door and doing all necessary welding and cutting. Davis-Bournonville welding apparatus was used. The tank is to be mounted on a truck and used for heating asphalt used in repairing roads.

Export Manufacturers To Meet in October at N. Y.

Announcement has been made by the convention committee of the American Manufacturers' Export Association that the eleventh annual convention of the association would be held at the Waldorf-Astoria Hotel in New York on Oct. 14. The convention this year will be limited to a one-day session followed by a banquet in the evening. This will be the first time in the history of the association that the annual convention will continue for one day only.

It is planned by limiting the proceedings to one day to make the convention of more interest and to eliminate many of the unnecessary features which tend to make so many conventions tiresome and uninteresting. Social plans are under way to make the banquet an event in export circles.

Machinery Companies Consolidate for Mass Production

The Austin Machinery Corporation of New York and Chicago officially announces the consolidation of the F. C. Austin Machinery Co., the Linderman Steel and Machine Co., F. C. Austin Drainage Excavator Co., Toledo Bridge and Crane Co., Municipal Engineering and Contracting Co. and other large manufacturers of kindred lines with plants at Toledo, Ohio, Muskegon, Mich., Winthrop Harbor, Ill., and Woodstock, Ont. The combined energy and capacity of these organizations will be devoted to mass production and to supplying the most complete line of earth-moving and concrete mixing machinery to meet an unprecedented period of construction, excavation and irrigation. Distributing points will be extended throughout the world to facilitate the service and distribution of this broad line of contractors' requirements.

The Air Service Mechanics' School, Kelly Field, Texas

The fiscal year of 1921 finds the Air Service Mechanics' School, Training Department of the Air Service Mechanics' School at Kelly Field, Tex., with 410 students enrolled. These students have been drawn from all parts of the Air Service. Some are recruits, while others are members of different tactical organizations. The number of students enrolled in each course is as follows:

Course for airplane mechanicians	154
Course for engine mechanicians	167
Course for auto repairmen	20
Army paperwork and stenography	16
Aircraft armament	31
Awaiting instruction or in hospital, etc.	22
Total	410

In addition to the above there are organized courses for electricians, instrument repairmen, blacksmiths and machinists. Plans of instruction are completely drawn up; hangar space is ready; but the complete list of equipment has not yet been delivered. The course for parachute repairmen has graduated a number of students but at present no classes are receiving instruction in this work. However, the instructors in this course are preparing material for the next class, testing parachutes and repairing chutes for pilots. They are also constructing a double harness which was recently presented at McCook Field, Dayton, Ohio. With this new jumping harness a jumper can release himself at any time in case of landing on a building, in the water or other inconvenient places.

Young Succeeds Colby on Engineering Council

The American Society for Testing Materials has just appointed C. D. Young as its representative on Engineering Council to succeed Albert Ladd Colby. Mr. Young is general supervisor of stores, Pennsylvania System, Broad St. Station, Philadelphia, and vice president of the American Society for Testing Materials.

Oxweld Opens San Francisco Office

The Oxweld Acetylene Co., manufacturer of oxyacetylene welding and cutting apparatus, has established Pacific Coast sales and distributing headquarters at San Francisco, with offices at 1077 Mission St. Additional sales representatives' offices are maintained at the following points: Los Angeles, 646 Maple Ave.; Salt Lake City, 908 Kearns Building; Portland, 90 First St.; Seattle, 433 Pioneer Building.

Leo Romney, with headquarters at San Francisco, is Pacific sales manager. The territory embraces the states of Washington, Oregon, Idaho, Utah, Arizona, California, Nevada and the counties of Lincoln, Sweetwater and Uintah in Wyoming. This territory was formerly served from Chicago and Los Angeles. Removal of headquarters to San Francisco was made necessary to secure a more central location for supplying the company's rapidly growing business in the Pacific states where its apparatus is extensively used in the metal industries and shipyards.

Eisler Enters Engineering Field

Charles Eisler has entered the consulting engineering field and is now devoting his time to designing and developing special and automatic machines for the manufacture of standard, miniature and gas-filled lamps. The organization will also maintain a well-equipped department for manufacturing wire product used in the incandescent lamps for which the very latest machines are being installed. Temporary office, 159 Clifton Ave., Newark, N. J.

Lee Joins Staff of Southwark Co.

James T. Lee has been recently added to the sales engineering staff of the Southwark Foundry and Machine Co., of Philadelphia, Pa. Mr. Lee for several years past was vice president in charge of sales of the Hanna Engineering Works, of Chicago. It is the purpose of the Southwark Foundry and Machine Co. to greatly broaden its field of activity by adding to its present complete line of hydraulic and power machinery a full line of pneumatic and hydro-pneumatic riveters and foundry molding machines.

Business Items

The Southwark Foundry and Machine Co., of Philadelphia, Pa., is adding to its present line of hydraulic and power machinery a full line of pneumatic hydro-pneumatic riveters and foundry molding machines.

The Vermont Tap and Die Corporation is a new organization located in Newport, Vt. It will start manufacturing high-grade taps and dies about Oct. 1. The officers are P. O. Miller, of Prouty & Miller, president; H. E. Paine, vice president and general manager; B. W. Wilcox, of the Gilman Store, treasurer.

The Southern Motor Manufacturing Association, Ltd., Houston, Tex., has broken ground for the erection of two additional units of its plant on the Houston ship canal. Both will be of sawtooth steel construction, one 121 x 480 ft. and the other 75 x 150 ft. The larger will be used for the manufacture of passenger cars and the other as a warehouse.

The Moline Tool Co., Wilson P. Hunt president, has taken over operation of the Moline Machinery Co., stockholders of the later organization being given option of cash sales of stock or exchange for stock issue of the tool company. The machinery company factory will be known as plant No. 2 of the tool company. It will continue the manufacture of special machinery not produced at the tool company's factory.

The Visible Pump Co., Indianapolis, Ind., plans the construction of a factory for the manufacture of gasoline tanks. The company will need a miscellaneous machine equipment for manufacturing purposes.

Work will begin about Sept. 15 on the construction of a new factory building for the Mutual Truck Co. at Sullivan, Ind. The company, according to Robert E. Petrie, president, will need miscellaneous machine equipment for the manufacture of trucks.

The Wert Manufacturing Co., of Kendallville, Ind., has begun work on a factory to manufacture machinery for concrete work. The company will need boilers for power plant, engine-room equipment and miscellaneous machinery for manufacture of concrete machines to cost $200,000.

The Moline Plow Co., Moline, Ill., a subsidiary of the Willys corporation, is in negotiation with the Root & Vander-Voort Engineering Co. for purchase of all its shops except the automobile department. Nearly all motors used in tractors and other machines produced by the Moline Plow Co. have been manufactured at the R. & V. plant.

The Wall Pump and Compressor Co., Quincy, Ill., with $200,000 capital fully subscribed, has leased factory space of 20,000 sq.ft. and expects to be in operation in ninety days. Contracts for machinery have already been let. The company will manufacture dry vacuum pumps and air compressors of all sizes, gas-engine governors and other specialties.

Personals

JOHN M. BILES, general manager, and TORSTEN A. GYLLSDORFF, superintendent of the Detroit Reamer and Tool Co., Detroit, Mich., have recently announced their resignation. They have incorporated the Standard Reamer and Tool Co., at 410-424 Elmwood Ave., Detroit, Mich., to manufacture a complete line of standard reamers, cutters and special tools. The officers of the company are: Arthur J. Stock, president; Torsten A. Gyllsdorff, secretary and superintendent; Frank J. Trippensee, vice president; John M. Biles, treasurer and general manager.

LOUIS A. DELANEY, formerly with the F. X. Hooper Co., Inc., Glenarm, Md., has joined the American Sheet Metal Corporation, Philadelphia, as manager.

W. A. TOOHILL has been appointed sales representative for the Dayton, Ohio, territory for the Quigley Furnace Specialties Co., manufacturer of Q-steel and Q-alloy pots and boxes. Mr. Toohill was for some years metallographist with the International Motors Co. at the Plainfield and New Brunswick, N. J., plants of that company.

WILLIAM P. STOUT has been appointed district manager of sales of the Philadelphia office of the Columbia Steel and Shafting Co., Pittsburgh, Pa., succeeding John T. Seaman, who is now district manager of sales of the Pittsburgh office.

ELTON G. NAZARENE, until recently connected with the Hart-Parr Co., Charles City, Iowa, for a number of years, has been appointed to the faculty of the engineering department of the University of Nebraska as instructor of foundry metallurgy and metallography.

HENRY MCENELLY, for over ten years with the La Pointe Machine Tool Co., of Hudson, Mass., is a partner in and general manager of the Hurlbut-Rogers Broach Co., of Hudson. The company is manufacturing broaches for the trade in a small but well-equipped shop.

Condensed-Clipping Index of Equipment

Patented Aug. 20, 1918

Press, Verson, No. 0 Inclinable Power Bench

La Salle Machine Works, 3013 South La Salle Street, Chicago.

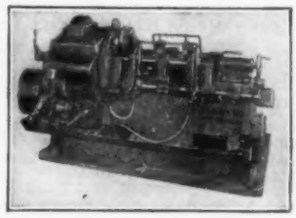
"American Machinist," July 22, 1920

This machine is adapted for use on small parts where speed and accuracy are required. It is provided with a hardened tool steel clutch with the addition of an automatic safety device which disengages at each revolution of the press, even without the release of the treadle. The machine is of the open-back type and can be furnished with a table and legs if desired. Specifications: Stroke, 1 in. Adjustment of slide, 1 in. Bed to slide, with stroke down and adjustment up, 5 in. Area, top of bolster, 6 x 8 in. Thickness of bolster, 3 in. Width of opening through back, 4 in. Height, bench to center of shaft, 21 in. Flywheel, 12 in. diameter, by 2½ in. face; speed, 225 r.p.m. Hole in bed, 3 x 3½ in. (This description has been reprinted from the Aug. 5 issue of the "American Machinist," in which appeared the illustration of the No. 00 instead of the No. 0.)

Milling Machine, Crankshaft, Stamets

Wm. K. Stamets, Pittsburgh, Pa.

"American Machinist," Aug. 5, 1920



This machine is intended for milling the edges of the webs of crankshafts. There are two arbors, each carrying two cutters 7 in. in diameter and easily removable for grinding the cutters. The arbors are supported by rocker-arms so that they may move while the crankshaft revolves between them. The motion of the rocker-arms is controlled by master cams, counterweighted levers keeping the cam rollers in contact with the cam faces. The cutters are relieved from the work when the cut is finished. The cutter spindles are driven through gears so arranged as to allow the necessary movement without disturbing the mesh. Two Fulflo pumps supply coolant to the cutters, while a third pumps oil to the bearings. Floor space, 3½ x 8 ft. Height 4 ft. Weight, 8,000 lb.

Milling and Grinding Attachment, Lathe, Moor

Eccles & Smith Co., San Francisco, Cal.

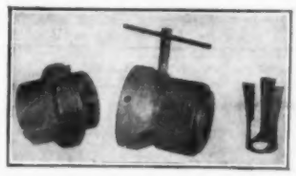
"American Machinist," Aug. 5, 1920

This device is intended for attachment to the toolrest of a lathe. It consists of a vertical column carrying a saddle having either a milling or grinding quill mounted thereon, a motor-driven countershaft suspended from a trolley rail, and a wormwheel device for indexing the work. Longitudinal feed is obtained by means of an auxiliary countershaft belted to the small step of the lathe cone. The saddle can be raised or lowered or rotated on the column. The milling spindle and quill can be easily removed and the grinding quill and spindle substituted, arrangement being provided for changing the speed. The countershaft is motor driven, and it so suspended that the motor overbalances the driving pulley to keep the vertical belt in tension.

Chuck, Draw-In Collet, Ney

J. M. Ney Co., Hartford, Conn.

"American Machinist," Aug. 5, 1920

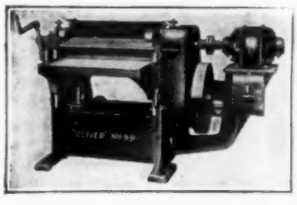


The chuck is mounted on the spindle nose by means of a threaded adapter. Rotation of the sleeve produces longitudinal travel of a shouldered nosepiece which bears on the end of the collet and forces it into a cone-shaped opening in the chuck body. Tightening pressure is obtained by the pinion key. The longitudinal thrust between the body and the sleeve is taken by twenty-six hardened balls. The chuck is made entirely of steel. It is furnished with six tool-steel collets ranging in capacity from ⅜ to 1 in., advancing by ⅛ in. steps. As each collet may be used on work 1/16 in. over- or under-size, considerable flexibility is provided. Collets can also be furnished advancing by 1/16 in.

Surfacer, Motor-Driven, Oliver

The Oliver Machinery Co., Grand Rapids, Mich.

"American Machinist," Aug. 5, 1920



The No. 99 surfacer was formerly run by belt drive, but it has been arranged for motor drive. The drive to the cutter cylinder is direct from a standard motor running at 3,600 r.p.m.

Truck, Electric, Tiering, Karry-Lode

Karry-Lode Industrial Truck Co., Inc., Long Island City, N. Y.

"American Machinist," Aug. 5, 1920

This truck is intended for conveying, lifting and tiering over smooth, level floors. The platform is 26 x 54 in., and when in its lowest position is 11 in. above the floor. It will raise a load of 4,000 lb. 65 in. above the floor at a rate of 3 ft. per min. Hoisting is accomplished by a motor connected to a winding drum through a train of gears and a multiple disk clutch. The motor is allowed to accelerate before the clutch is applied to pick up the load. The platform is lowered by gravity, and it is controlled by means of a single lever. A drum-type controller is used, and the battery box is spring suspended and cushioned on all sides.

Boring Mill, Vertical, Storm

The Storm Manufacturing Co., 6th Ave. and 4th St., Minneapolis, Minn.

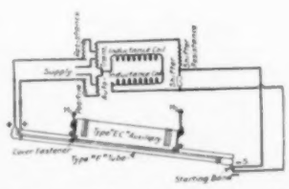
"American Machinist," Aug. 5, 1920

The boring bar works from beneath the table, and provision is made to protect the bearing from chips. Four adjustable cutting heads are furnished as regular equipment. Speed variation is obtained by means of a cone pulley; and positive feed by means of gears and a central feed screw. By means of an automatic stop the bar returns to its starting position after the hole has been bored to the proper depth. Capacity: holes from 2½ to 7½ in. diameter and 20 in. depth with regular equipment. Work table, 24 x 30 in. Height, 44 in. Floor space, 30 x 36 in. Approximate shipping weight, 1,000 lb.

Lamp, Electric, 85 Per Cent P. F., Cooper-Hewitt

The Cooper-Hewitt Electric Co., Hoboken, N. J.

"American Machinist," Aug. 5, 1920



By means of suitable auxiliary equipment the power factor of the alternating current, mercury-vapor-arc lighting units have been increased from 52 to 85 per cent. This has been accomplished by replacing the choke coils of the former auxiliary by a positive low resistance unit. Further advantages of the auxiliary are a saving of 14 lb. in weight over the old type, and an increase in the allowable voltage variation, since the lamp has a regulation of 25 per cent. while that of the old type was only 12 per cent. The wattage of the lamp is 430, which has increased the candlepower about 12 per cent. Since the tube will operate at 3.8 amperes d.c., normal, a further slight reduction of weight has been made possible, as the auto-transformer need not be as heavy as formerly.

Clip, paste on 3 x 5-in. cards and file as desired

New Publications

Exporters' Gazetteer of Foreign Markets. Compiled and edited by Lloyd R. Morris. Seven hundred sixty-six 6¾ x 8½-in. pages, with a 12 x 20-in. map. Published by the "American Exporter," 17 Battery Place, New York City. Price $10.

This is a ready reference guide to the imports and exports industries, banking, shipping, products, climatic and other local conditions of every foreign market. A feature of the arrangement of the work is that all the commercial and industrial statistics and weights and measures have been converted into dollars and into American measurements, so that the business executive can get his facts immediately without going through the process of converting from foreign currencies or measures. It is believed that this is the first time that a book of this nature has been compiled in that manner. Furthermore, it is the first time that all these details of foreign conditions have been available in one volume, as heretofore it has been necessary to consult local publications and various governmental reports in order to cover the same ground.

The countries of the world have been grouped in alphabetical order by continents and other major geographical divisions so that adjoining markets are found together.

Under each country will be found detailed information upon area and population, commerce, production and industry, railroads, telegraphs and telephones, money, weights, measures, commercial language, local advertising media, principal shipping routes, customs tariffs, consular regulations and consular representatives, cable rates, mail time, postal rates, and regulations respecting parcel post, money orders and reply coupons. The section under each country dealing with commerce contains tables showing the value of the total foreign trade for a series of years, the value of imports and exports by commodities and countries, and the value of its imports from and exports to the United States for ten or more years.

Under production and industry there will be found with respect to each country a detailed survey of its various industries, including agriculture, livestock, forest and mineral resources, fisheries and manufactures, and in the majority of cases there has been included a table showing the number of each kind of manufacturing enterprise, together with the number of persons employed, the capitalization, the value of annual output and the consumption of raw material.

Tables are also given showing the world's production and consumption of the principal grains, minerals and other primary commodities, also the world's equipment of shipping, railroads, telegraphs and automobiles.

Comparative tables showing the relative growth of the export and import trade of the United States, Great Britain, France and Germany are also given.

Separate sections of the book are devoted to the new states of Czecho-Slovakia, Jugo-Slavia, Poland, Finland, Latvia, Lithuania, Esthonia, Ukrania, and Austria and Hungary as reconstructed.

The book includes a number of charts, a map of the world, a map of the New Europe and line maps of each of the markets.

Standard Electrical Dictionary. By T. O'Conor Sloane. Seven hundred sixty-seven 4¾ x 7-in. pages. 477 illustrations. Bound in dark blue cloth boards. Published by the Norman W. Henley Publishing Co., 2 West 45th St., New York City. Price $5.

This is a book of reference for those interested in electrical terms and apparatus. It is, however, more of a condensed encyclopedia than a dictionary. No attempt is made to guide pronounciation in any case, but the definitions or descriptions are rather more extended than a mere dictionary would give. The text is divided into two parts, the first part containing material arranged in alphabetical order, which has appeared in previous editions. The second part contains more up-to-date additions, also arranged in alphabetical order. This has saved the plates used in printing the first part, but in many cases makes it considerably more inconvenient for the user to find what he wants, since if he does not find the term he wants in the first part he is supposed to refer to the second. The numerous illustrations used add greatly to the value of the book and make clear definitions that would otherwise be obscure.

Motor Boats and Boat Motors. By Victor W. Page and A. Clark Leitch. Five hundred twenty-four 6 x 8¾-in. pages, 372 illustrations, bound in dark blue cloth boards. Published by the Norman W. Henley Publishing Co., 2 West 45th St., New York City. Price $4.

This is a handbook for those interested in motor boats. It takes up the various details of modern hulls and marine engines, boat design and construction, installation of motors, and gives advice on boat and engine maintenance and repair. A notable feature is the method of dealing with boat building.

Everything from the selection of lumber, laying out the boat molds, to the finished craft is outlined in detail.

The various chapters deal with motor boat classification, hull construction and design details, motor boat fittings, motor boat operation and care, five popular boat designs, types and operating principles of boat motors, typical boat motors, power plant auxiliaries, power plant installation, propelling devices, care and repair of motors, seaplanes and flying boats.

The Organization of Industrial Scientific Research, by C. E. Kenneth Mees, D. Sc. Director of the Research Laboratory of the Eastman Kodak Co., 167 pp., 5¼ x 7 in. Published by McGraw-Hill Book Co., Inc., 239 West 39th St., New York. Price, $2.

It is very refreshing to the jaded reviewer to pick up a book so well written as this one of Dr. Mees. In his preface the author states that his purpose has been to supply answers to such questions on the establishment of an industrial research laboratory as "What will it cost—to start—to support? Where shall I get the men? What should it do? What may I expect to get from it, and when? What position in my organization should it occupy? What should be its own organization?" Suffice it to say that the questions are answered in a thoroughgoing manner that will well repay the man who is interested in this subject.

Export Opportunities

The Bureau of Foreign and Domestic Commerce, Department of Commerce, Washington, D. C., has inquiries for the agencies of machinery and machine tools. Any information desired regarding these opportunities can be secured from the above address by referring to the number following each item.

A manufacturing company in Spain desires to purchase and secure an exclusive agency for all kinds of motors and tool machinery, railway material, miners' and general contractors' machinery, etc. Quotations should be given c.i.f. Spanish ports. Correspondence may be in English. References. No. 33,338.

A firm of mechanical and electrical engineers in India desires to receive quotations from manufacturers on a large number of motors and generating sets, specifications of which were forwarded. Prices to include effective packing for shipment and delivery f.o.b. American port. A list of firms represented by this company was forwarded. No. 33,421.

A company in Switzerland desires to secure an agency on a commission basis for the sale of machines for tools and precision instruments, as well as any other technical article. Quotations should be given c.i.f. Antwerp. Payment to be made in 30 days upon receipt of the goods. Correspondence may be in English. References. No. 33,387.

A commercial agent in Italy desires to secure the representation of manufacturers of automobiles and agricultural machinery and accessories. Correspondence may be in English. Reference. No. 33,044.

A manufacturer and commercial representative in Poland desires to secure an agency from firms for the sale of textiles, machinery, and mill supplies. Correspondence may be in English. References. No. 33,433.

The representative of the Director of the Arsenal in a city in Rumania desires to receive catalogs and quotations on marine arsenal and dockyard equipment, machines, tools, marine engines, etc., to enable him to estimate and recommend purchases of such goods for the government. No. 33,436.

Trade Catalogs

Instruction Book and Parts Catalog. Explaining the operation and adjustment of the Heald Style No. 60 Cylinder Grinding Machine: The Heald Machine Co., Worcester, Mass. Catalog, pp. 56, 6 x 9 in. The first section gives setting-up directions, including floor plan and front elevation drawings. Instructions are given relative to bearings, adjustments, grinding wheels and wet and dry grinding. There are also illustrations of machines at work. The second section gives a drawing of the entire machine. This drawing carries numbers, which refer to line drawings of the various units of the machine.

Fan System of Heating, Ventilating and Humidifying. Buffalo Forge Co., Buffalo, N. Y. Catalog No. 700, pp. 115, 8½ x 11 in. This catalog is printed on coated stock and is the most efficient one that this company has published in this line. It is for all practical purposes a handbook on heating and ventilating inasmuch as some parts are taken from its handbook on heating and ventilating.

Conoidal Fans. Buffalo Forge Co., Buffalo, N. Y. Catalog No. 421, pp. 51, 8½ x 11 in. This catalog contains tables of performances that will enable engineers and architects to make fan selection to meet any demands in ordinary heating and ventilating practice.

Air Separator. The Griscom-Russell Co., 90 West St., New York. Bulletin No. 1111, 6 x 9 in. This catalog gives the construction and installation of the Stratton air separator and also gives three pages of its partial list of users.

Roller Chains, Block Chains, Special Chains and Sprockets. Baldwin Chain and Manufacturing Co., Worcester, Mass. Catalog F, pp. 69, 6 x 9¼ in. This is a complete catalog with descriptions and illustrations on the subject of chain power transmission. It also gives tables of pitch line diameters of sprockets up to 100 teeth and dimensions of sprockets.

Twist Drills and Reamers. The Whitman & Barnes Manufacturing Co., Akron, Ohio. Catalog No. 92, pp. 120, 5¼ x 7¼ in. This is a catalog of twist drills and socket reamers made by the Whitman & Barnes Manufacturing Co. It also contains tables for giving tap drill sizes for various kinds of threads as well as for pipe taps, decimal equivalents, values of fractional sizes expressed in millimeters, speed and feed for "Diamond" and "Hercules" high-speed twist drills.

Catalogs Wanted

The Alent Machine Tool Co., 479 St. Paul St., Rochester, N. Y., would be pleased to receive catalogs from the manufacturers of machinery, tools, etc., in order to start its files.

Forthcoming Meetings

The National Gas Engine Association, Monadnock Bldg., Chicago, Ill., will hold its thirteenth annual convention at the Congress Hotel, Chicago, on Sept. 1, 2 and 3.

The American Steel Treaters' Society and the Steel Treating Research Society will hold their second annual convention and exhibition at the Commercial Museum, Philadelphia, Pa., on Sept. 14 to 18, inclusive. J. A. Pollack, of the Pollak Steel Co., Cincinnati, Ohio, is secretary of the former society.

The American Foundrymen's Association will hold its annual convention and exhibit at Columbus, Ohio, on Oct. 4 to 9. C. E. Hoyt, 1401 Harris Trust Building, Chicago, Ill., is secretary.

An exposition of U. S. manufacturers at Buenos Aires, Argentine Republic, S. A., has been arranged for the month beginning Nov. 15. Information can be obtained from the American National Exhibition, Inc., Bush Terminal Sales Building, 132 West 42nd St., New York.

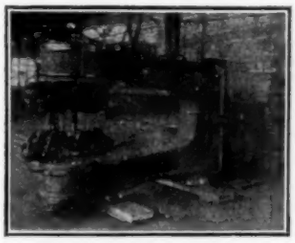
Condensed-Clipping Index of Equipment

Patented Aug. 20, 1918

Micrometer, Direct-Reading, Simplex
Consolidated Tool Works, Inc., 261 Broadway, New York, N. Y.
"American Machinist," Aug. 5, 1920

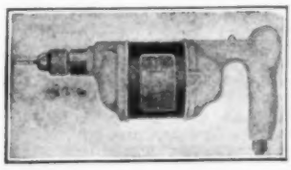
For the purpose of minimizing errors in reading, this micrometer is made to read directly in figures. The part of the thimble nearest the frame does not revolve, but is splined on the barrel. Two small dials within this thimble are actuated by the revolving thimble in such a way as to show through the windows the numerals that correspond to the position of the movable anvil of the micrometer. Tenths of an inch are read from the last figure exposed on the barrel, hundredths from the dial on the left and thousandths from the one on the right. Half and quarter thousandths may be estimated. The tool is made in sizes from 1 to 6 in. It can be furnished either with or without ratchet stop or locknut; and it is claimed to be accurate within one ten-thousandth of an inch.

Welding Machine, Electric, Two-spot, Rotatable Head, Federal
Federal Machine and Welder Co., Warren, O.
"American Machinist," Aug. 5, 1920



The machine has a 60-in. throat depth and is guaranteed to weld two sheets of steel stock from 24-gage up to 8-gage thickness. It is built with 4-kva. welding transformers in the upper and lower rotating heads. Primaries are in parallel while the secondaries are in series, so that two spot welds must be made at the same time. The regulating transformer supplies power to the welding transformer in eight voltage steps. The welding electrodes can be separated a maximum distance of 5 in., while welds may be made from 3 to 8 in. apart. The maximum rotation of the head is 90 deg. With an air line supply of 80 lb. per square in., a pressure of from 300 to 700 lb. is applied between the electrodes during heating, and 1,200 lb. pressure may be exterted for finishing the weld.

Drilling Machine, Portable, Electro
Electro-Magnetic Tool Co., 2902-8 Carroll Ave., Chicago, Ill
"American Machinist," Aug. 5, 1920



The handle of the device is of the pistol-grip type. The motor is series wound, fan cooled, and operates on voltages either 10 per cent above or below the normal. Adjustable ball bearings are used on the armature and a ball thrust bearing on the spindle. The heat-treated steel gears run in grease in a cast-aluminum case, which is so constructed as to exclude grease from the motor chamber. A 3-jaw chuck is used. The machines are built in a range of sizes, having a capacity up to ¼ in. drills. The full-load speeds vary from 750 to 8,000 r.p.m. and the weights from 4 to 8 pounds.

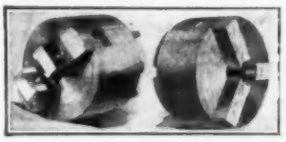
Press, Straightening, Crankshaft, Metalwood, No. 191
Metalwood Manufacturing Co., Detroit, Mich.
"American Machinist," Aug. 5, 1920

This press is intended for straightening automotive-engine crankshafts. It is a self-contained, motor-driven unit, but it can be furnished either for belt drive or for connection with an accumulator pressure supply. The ram is raised by means of coil springs acting through cables. The work is supported while under pressure by blocks placed on the bed, it being held all of the time between the spring-mounted centers, which are fastened together so as to form a movable carriage.

Grinding Machine, Thread-Chaser, Rickert-Shafer
Rickert-Shafer Co., Erie, Pa.
"American Machinist," Aug. 5, 1920

The machine is designed especially for grinding chasers of self-opening die heads. Either column- or bench-type machines can be furnished, and they can be equipped for either motor or line-shaft drive. Both the faces and the throats of chasers can be ground. For grinding faces, the fixture shown on the bench is used, adjustments being provided for varying the rake. The fixture shown on the machine is used when grinding throats, it being possible to grind chasers used for threading stock from ¼ to 6 in. diameter. S. K. F. ball bearings are used throughout. The wheel is rubber corundum of 6-in. diameter.

Chuck, Air-Operated, Lavoie
Frontier Chuck and Tool Co., 30 Letchworth St., Buffalo, N. Y.
"American Machinist," Aug. 5, 1920

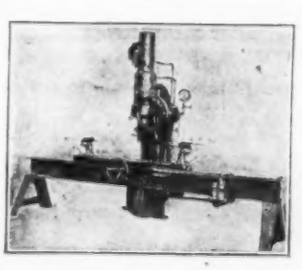


This chuck, originally used for shell work, has been designed for commercial purposes. It requires but one packing and single piping. The grip is released by exhausting the air, a coil spring returning the piston to its original position. The equipment includes one set of manufacturing jaws, one set of jaw pads, rough adapter casting, air box, and a quick-acting air valve. The chuck is made in two- and three-jaw types. The two-jaw type is made in three sizes, 6, 9 and 12 in., and is intended for brass work and odd shapes that require a simple method of chucking. The three-jaw type is made in four sizes, 10, 12, 15 and 18 in., and is for use on general production work.

Measuring Machine, Universal, S.I.P.
The Golden Co., 405 Lexington Ave., New York, N. Y.
"American Machinist," July 8, 1920

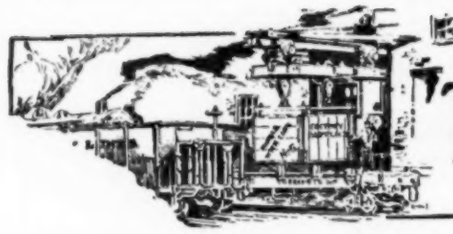
This machine, made by the Société Genevoise d'Instruments de Physique, Geneva, Switzerland, is intended for use as a primary standard of measurement. It can be used for measuring gages or parts of all descriptions, for measuring screw threads and as a rapid comparator. All measurements are made with reference to a standard scale mounted in a case, shown at the left side on top of the bed, it being read by means of a microscope, never coming in contact with the object being measured. The axes of the scale and of the work being measured are directly in line, thus reducing the chance of error. The headstock at the right contains an indicator to enable the obtaining of the same pressure for each measurement. The fixture in the center is for use when measuring screw threads.

Press, Straightening, Crankshaft, Metalwood, No. 597
Metalwood Manufacturing Co., Detroit, Mich.
"American Machinist," Aug. 5, 1920



This press is intended for straightening heavy automotive-engine crankshafts such as those used in tractors. Shafts up to 3 in. in diameter on the main bearing and 7½ ft. long can be handled. The centers are spring-mounted on a carriage movable along a bed of steel I-beam section. The work is supported while under pressure by blocks placed on the carriage, it being unnecessary to remove it from between the centers. The ram can be moved down to the work by the handwheel on the front of the cylinder. Pressure is furnished by the two-cylinder hand pump on the front of the bed. The ram is raised by means of a counterweight when the pressure is released.

Clip, paste on 3 x 5-in. cards and file as desired



THE WEEKLY PRICE GUIDE

IRON AND STEEL

PIG IRON—Quotations compiled by The Matthew Addy Co.:

	Current	One Year Ago
CINCINNATI		
No. 2 Southern	$45.60	$29.80
Northern Basic	44.80	27.55
Southern Ohio No. 2	46.80	28.55
NEW YORK—TIDEWATER DELIVERY		
2X Virginia (Silicon 2.25 to 2.75)	52.65	31.90
Southern No. 2 (Silicon 2.25 to 2.75)	50.70	33.95
BIRMINGHAM		
No. 2 Foundry	42.00@44.00	25.75
PHILADELPHIA		
Eastern Pa., No. 2x, 2.25-2.75 sil.	47.00@49.50*	30.65
Virginia No. 2	47.00*	30.85
Basic	44.50†	29.90
Grey Forge	43.50*	29.90
CHICAGO		
No. 2 Foundry local	46.00	27.25
No. 2 Foundry, Southern	48.70	31.75
PITTSBURGH, INCLUDING FREIGHT CHARGE FROM VALLEY		
No. 2 Foundry	45.65	28.15
Basic	46.00	27.15
Bessemer	46.00@47.00	29.35
MONTREAL		
Silicon 2.25 to 2.75%	43.25	.....

* F.o.b. furnace. † Delivered.

STEEL SHAPES—The following base prices per 100 lb. are for structural shapes 3 in. by ¼ in. and larger, and plates ¼ in. and heavier, from jobbers' warehouses at the cities named:

	New York		Cleveland		Chicago	
	Current	One Month Ago	One Year Ago	Current	One Year Ago	Current	One Year Ago
Structural shapes	$4.47	$3.97	$3.47	$5.00	$3.37	$3.97	$3.47
Soft steel bars	4.62	4.12	3.37	4.50	3.27	3.87	3.37
Soft steel bar shapes	4.62	4.12	3.37	.....	3.27	3.87	3.37
Soft steel bands	6.32	5.32	4.07	6.25	.....	.....	.....
Plates, ¼ to 1 in. thick	4.67	4.17	3.67	4.50	3.57	4.17	3.67

BAR IRON—Prices per 100 lb. at the places named are as follows:

	Current	One Year Ago
Mill, Pittsburgh	$4.25	$2.62
Warehouse, New York	4.57	3.37
Warehouse, Cleveland	3.52	3.22
Warehouse, Chicago	3.75	3.37

SHEETS—Quotations are in cents per pound in various cities from warehouse; also the base quotations from mill:

Blue Annealed	Large Mill Lots Pittsburgh	New York Current	New York One Year Ago	Cleveland	Chicago
No. 10	3.55-7.00	7.12@8.00	4.57	8.10	7.02
No. 12	3.60-7.65	7.17@8.05	4.57	8.15	7.07
No. 14	3.65-7.10	7.22@8.10	4.67	8.20	7.12
No. 16	3.75-7.20	7.32@8.20	4.77	8.30	7.22
Black					
Nos. 18 and 20	4.20-6.20	8.30@9.80	5.30	8.70	7.80
Nos. 22 and 24	4.25-6.25	8.35@9.85	5.35	8.75	7.85
No. 26	4.30-6.30	8.40@9.90	5.40	8.80	7.90
No. 28	4.35-6.35	8.50@10.00	5.50	8.90	8.00
Galvanized					
No. 10	4.70-8.00	8.80@11.50	6.20	9.00	8.15
No. 12	4.80-8.10	8.90@11.50	6.25	9.10	8.20
No. 14	4.80-8.10	8.90@11.60	6.30	9.10	8.35
Nos. 18 and 20	5.10-8.40	9.15@11.90	6.60	9.40	8.65
Nos. 22 and 24	5.25-8.55	9.30@12.05	6.75	9.55	9.05
No. 26	5.40-8.70	9.45@12.20	6.90	9.70	9.20
No. 28	5.70-9.00	9.75@12.50	7.20	10.00	9.50

Acute scarcity in sheets, particularly black, galvanized and No. 16 blue enameled. Automobile sheets are unavailable except in fugitive instances, when prices are 9.45c per lb. for No. 16; 9.50 for Nos. 18 and 20, and 9.55c for Nos. 22 and 24.

COLD FINISHED STEEL—Warehouse prices are as follows:

	New York	Chicago	Cleveland
Round shafting or screw stock, per 100 lb. base	$6.25	$5.80	$6.00
Flats, square and hexagons, per 100 lb. base	6.75	6.30	6.50

DRILL ROD—Discounts from list price are as follows at the places named:

	Per Cent.
New York	50
Cleveland	50
Chicago	50

NICKEL AND MONEL METAL—Base prices in cents per pound F.O.B. Bayonne, N. J.

	Nickel
Ingot and shot	43
Electrolytic	45

	Monel Metal		
Shot and blocks	35	Hot rolled rods (base)	40
Ingots	38	Cold rolled rods (base)	56
Sheet bars	40	Hot rolled sheets (base)	55

Special Nickel and Alloys	
Malleable nickel ingots	45
Malleable nickel sheet bars	47
Hot rolled rods, Grades "A" and "C" (base)	60
Cold drawn rods, grades "A" and "C" (base)	62
Copper nickel ingots	42
Hot rolled copper nickel rods (base)	52
Manganese nickel hot rolled (base) rods "D" — low manganese	64
Manganese nickel hot rolled (base) rods "D"— high manganese	67

Domestic Welding Material (Swedish Analysis)—Welding wire in 100-lb lots sells as follows, f. o. b. New York: 5/32, 8½c. per lb.; ¼, 8c.; 5/16 to ½, 7½c. Domestic iron sells at 12c. per lb.

MISCELLANEOUS STEEL—The following quotations in cents per pound are from warehouse at the places named:

	New York Current	Cleveland Current	Chicago Current
Openhearth spring steel (heavy)	7.00	8.00	9.00
Spring steel (light)	10.00	11.00	12.25
Coppered bessemer rods	9.00	8.00	6.75
Hoop steel	6.57	6.50	5.32
Cold-rolled strip steel	12.50	8.25	10.75
Floor plates	6.80	6.00	6.77

PIPE—The following discounts are to jobbers for carload lots on the Pittsburgh basing card, discounts on steel pipe, applying as from January 14, 1920, and on iron pipe from January 7, 1920.

BUTT WELD

Inches	Steel Black	Galvanized	Inches	Iron Black	Galvanized
⅜ to 3	54-57½%	41½-44%	⅜ to 1½	24½-34½%	8 -18½%
LAP WELD					
2	47 -50½%	34½-38%	1¼	.....	.....
2½ to 6	50 -53½%	37½-41%	1½	.....	.....
7 to 12	47 -50½%	33½-37%	2	20½-28½%	6½-14½%
13 to 14	37½-41 %	.....	4½ to 6	22½-30½%	9½-17½%
15	35 -38½%	.....	2½ to 4	22½-30½%	9½-17½%
			7 to 12	19½-27½%	6½-14½%
BUTT WELD, EXTRA STRONG PLAIN ENDS					
⅜ to 1½	52 -55½%	39½-43%	⅜ to 1½	24½-34½%	9½-19½%
2 to 3	53 -56½%	40½-44%			
LAP WELD, EXTRA STRONG PLAIN ENDS					
2	45 -48½%	33½-37%	1¼	.....	.....
2½ to 4	48 -51½%	36½-40%	1½	.....	.....
4½ to 6	47 -50½%	35½-39%	2	21½-29½%	8½-16½%
7 to 8	43 -46½%	29½-33%	2½ to 4	23½-31½%	11½-19½%
9 to 12	38 -41½%	24½-28%	4½ to 6	22½-30½%	10½-18½%
			7 to 8	14½-22½%	2½-10½%
			9 to 12	9½-17½%	5½-+2½%

	New York Black	New York Galv.	Cleveland Black	Cleveland Galv.	Chicago Black	Chicago Galv.
⅜ to 3 in. steel butt welded	40%	24%	40%	31%	54%40%	40½@30 %
2½ to 6 in. steel lap welded	35%	20%	42%	27%	50@40%	37½@27½%

Malleable fittings. Classes B and C, banded, from New York stock sell at plus 32%. Cast iron, standard sizes, net.

METALS

MISCELLANEOUS METALS—Present and past New York quotations in cents per pound, in carload lots:

	Current	Month Ago	Year Ago
Copper, electrolytic	19.00	19.25	21.75
Tin in 5-ton lots	49.00	61.50	70.00
Lead	9.25	9.00	5.50
Zinc	8.05	8.70	8.00
ST. LOUIS			
Lead	8.90	8.87½	5.25
Zinc	7.70@8.40	8.37½	7.65

At the places named, the following prices in cents per pound prevail, for 1 ton or more:

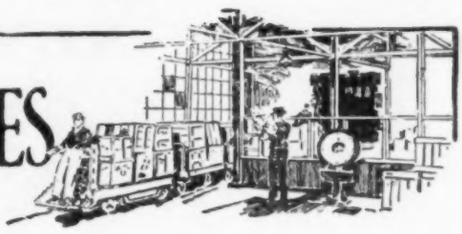
	New York Current	New York Month Ago	New York Year Ago	Cleveland Current	Cleveland Year Ago	Chicago April 8 Current	Chicago April 8 Year Ago
Copper sheets, base	33.50	33.50	29.50	32.00	33.50	36.00	36.50
Copper wire (carload lots)	31.25	31.25	26.50	29.50	29.50	27.00	25.00
Brass sheets	28.50	28.50	23.00	29.00	29.00	27.00	28.00
Brass pipe	33.00	33.00	34.00	34.00	36.00	35.00	37.00
Solder (half and half) (case lots)	38.00	33.00	45.00	40.50	41.00	38.00	41.00

Copper sheets quoted above hot rolled 16 oz., cold rolled 14 oz. and heavier, add 2c.; polished takes 5c. per sq.ft. extra for 20-in. widths and under; over 20 in., 7½c.

BRASS RODS—The following quotations are for large lots, mill. 100 lb. and over, warehouse; net extra:

	Current	One Year Ago
Mill	25.00	19.00
New York	27.00	21.50
Cleveland	27.00	30.00
Chicago	26.00	30.00

SHOP MATERIALS AND SUPPLIES



ZINC SHEETS—The following prices in cents per pound prevail:

Carload lots f.o.b. mill..... 12.50

	Warehouse			
	—In Casks—		— Broken Lots —	
	Current	One Year Ago	Current	One Year Ago
Cleveland	15.00	12.50	15.50	13.00
New York	14.00	11.50	14.50	12.50
Chicago	15.00	16.50	15.00	16.00

ANTIMONY—Chinese and Japanese brands in cents per pound, in ton lots for spot delivery, duty paid:

	Current	One Year Ago
New York	7.50	9.50
Chicago	7.75	10.25

OLD METALS—The following are the dealers' purchasing prices in cents per pound:

	— New York —			
	Current	One Year Ago	Cleveland	Chicago
Copper, heavy, and crucible	16.25	19.00	15.00	15.50
Copper, heavy, and wire	15.25–15.75	18.00	14.50	15.00
Copper, light, and bottoms	13.00	15.50	13.00	14.00
Lead, heavy	7.00	5.00	7.00	7.50
Lead, tea	5.00	3.75	4.50	6.00
Brass, heavy	10.25	12.50	11.00	15.50
Brass, light	7.75–8.00	8.50	8.00	9.50
No. 1 yellow brass turnings	9.00–9.50	10.00	8.50	9.50
Zinc	5.25	4.50	4.50	5.50

ALUMINUM—The following prices are from warehouse at places named:

	New York	Cleveland	Chicago
No. 1 aluminum, 98 to 99% pure, in ingots for remelting (1-15 ton lots), per lb.	33.00	34.00c.@35.00c.	33.50

COPPER BARS—From warehouse sell as follows in cents per pound, for ton lots and over:

	Current	One Year Ago
New York (round)	38.00	33.00
Chicago	29.00	31.00
Cleveland	32.00	35.50

BABBITT METAL—Warehouse price per pound:

	—New York—		—Cleveland—		— Chicago —	
	Current	One Year Ago	Current	One Year Ago	Current	One Year Ago
Best grade	90.00	90.00	60.50	80.00	60.00	75.00
Commercial	50.00	50.50	21.00	18.50	15.00	15.00

SHOP SUPPLIES

NUTS—From warehouse at the places named, on fair-sized orders, the following amount is deducted from list:

	— New York —		— Cleveland —		— Chicago —	
	Current	One Year Ago	Current	One Year Ago	Current	One Year Ago
Hot pressed square	+ $6.00	$1.50	$ .50	$2.25	List	2.00
Hot pressed hexagon	+ 6.00	1.50	.50	2.25	List	2.00
Cold punched hexagon	+ 6.00	1.50	.50	2.25	List	1.30
Cold punched square	+ 6.00	1.50	.50	2.25	List	1.30

Semi-finished nuts, ⅜ and smaller, sell at the following discounts from list price:

	Current	One Year Ago
New York	30%	50–10%
Chicago	50%	50%
Cleveland	50%	60-10-10%

MACHINE BOLTS—Warehouse discounts in the following cities:

	New York	Cleveland	Chicago
½ by 4 in. and smaller	+ 20%	20%	20%
Larger and longer up to 1½ in. by 30 in.	+ 20%	20%	10%

WASHERS—From warehouses at the places named the following amount is deducted from list price:

For wrought-iron washers:

New York..... list Cleveland..... $2.50 Chicago..... $3.00

For cast-iron washers, ⅜ and larger, the base price per 100 lb. is as follows:

New York..... $7.00 Cleveland..... $4.50 Chicago..... $4.75

CARRIAGE BOLTS—From warehouses at the places named the following discounts from list are in effect:

	New York	Cleveland	Chicago
½ by 6 in. and smaller	+ 20%	35%	10%
Larger and longer up to 1 in. by 30 in.	+ 20%	20%	5%

COPPER RIVETS AND BURS sell at the following rate from warehouse:

	Rivets		Burs	
	Current	One Year Ago	Current	One Year Ago
Cleveland	20%	20%	10%	20%
Chicago	net	20%	net	20%
New York	25%	40%	net	40%

RIVETS—The following quotations are allowed for fair-sized orders from warehouse:

	New York	Cleveland	Chicago
Steel ⅜ and smaller	List Net	40%	30%
Tinned	List Net	40%	30%

Boiler, ¾, ⅞, 1 in. diameter by 2 to 5 in. sell as follows per 100 lb.:

New York..... $6.00 Chicago..... $5.62 Pittsburgh..... $4.5

Structural, same sizes:

New York..... $7.10 Chicago..... $5.72 Pittsburgh..... $4.60

MISCELLANEOUS

SEAMLESS DRAWN TUBING—The base price in cents per pound from warehouse in 100-lb. lots is as follows:

	New York	Cleveland	Chicago
Copper	34.00	34.00	35.00
Brass	33.00	34.00	34.00

The prices, of course, vary with the quantity purchased. For lots of less than 100 lb., but not less than 75 lb., the advance is 1 c.; for lots of less than 75 lb., but not less than 50 lb., 2½c. over base (100-lb. lots); less than 50 lb., but not less than 25 lb., 5c. should be added to base price; quantities from 10-25 lb., extra is 10c.; less than 10 lb., add .15-20c.

Double above extras will be charged for angles, channels and sheet metal mouldings if ordered in above quantities. Above extras also apply to brass rod other than standard stock sizes—stock sizes being considered as ⅛-2 in. inclusive in rounds, and ⅛-1½ in., inclusive, in square and hexagon—all varying by thirty seconds up to 1 in. by sixteenths over 1 in. On shipments aggregating less than 100 lb., there is usually a boxing charge of $1.50.

LONG TERNE PLATE—In Chicago No. 28 primes from stock sell, nominally, for $12.50 per 100 lbs.

In Cleveland—$10 per 100 lbs.

COTTON WASTE—The following prices are in cents per pound:

	— New York —			
	Current	One Year Ago	Cleveland	Chicago
White	15.00@17.00	13.00	16.00	11.00 to 14.00
Colored mixed	9.00@14.00	9.00–12.00	12.00	9.50 to 12.00

WIPING CLOTHS—Jobbers' price per 1000 is as follows:

	13½x13½	13½x20½
Cleveland	55.00	65.00
Chicago	41.00	43.50

SAL SODA sells as follows per 100 lb.:

	Current	One Month Ago	One Year Ago
New York	$3.00	$3.00	$1.75
Philadelphia	2.75	2.75	1.75
Cleveland	3.00	2.50	2.75
Chicago	2.75	2.50	2.00

ROLL SULPHUR in 360-lb. bbl. sells as follows per 100 lb.:

	Current	One Month Ago	One Year Ago
New York	$3.90	$3.90	$3.65
Philadelphia	3.65	3.65	3.62
Chicago	4.10	5.00	4.12½

COKE—The following are prices per net ton at ovens, Connellsville:

	July 8	July 1	June 24
Prompt furnace	$17.50@$18.50	$17.50@$18.50	$15.00@$16.00
Prompt foundry	18.00@19.00	18.00@19.00	16.00@17.00

FIRE CLAY—The following prices prevail:

		Current
Ottawa, bulk in carloads	Per Ton	$8.00
Cleveland	100-lb. bag	1.00

LINSEED OIL—These prices are per gallon:

	—New York—		—Cleveland—		—Chicago—	
	Current	One Year Ago	Current	One Year Ago	Current	One Year Ago
Raw in barrels, (5 bbl. lots	$1.48	$2.25	$1.86	$2.15	$1.67	$2.48
5-gal cans, (without cans)	1.51*	2.40	2.15	2.40	1.92	2.68

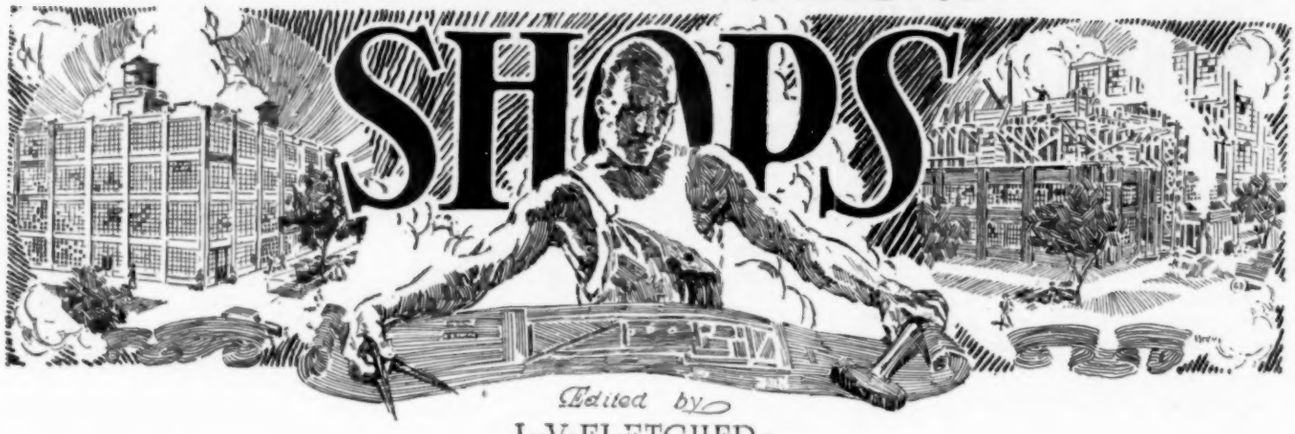
*To this *oil* price must be added the cost of the cans (returnable), which is $2.25 for a case of six.

WHITE AND RED LEAD—Base price per pound:

	Red				White	
	Current		One Year Ago		Current	One Year Ago
	Dry	In Oil	Dry	In Oil	Dry and In Oil	Dry and In Oil
100 lb. keg	15.50	17.00	13.00	14.50	15.50	13.00
25 and 50-lb. kegs	15.75	17.25	13.25	14.75	15.75	13.25
12½-lb. keg	16.00	17.50	13.50	15.00	16.00	13.50
5-lb. cans	18.50	20.00	15.00	16.50	18.50	15.00
1-lb. cans	20.50	22.00	16.00	17.50	20.50	16.00

500 lb. lots less 10% discount. 2000 lb. lots less 10–2½% discount.

NEW *and* ENLARGED



Edited by
L-V-FLETCHER

Machine Tools

The following concerns are in the market for machine tools:

Mass., Lynn—G. Gianimo, 68 Tremont St. —automobile repair equipment.

Mass., Lynn—J. Iverson, 463 Broad St.—auto repair tools.

D. C., Washington—Purch. Agt. for The Panama Canal—37 plain milling cutters, 2¾ to 4 in. diameter, equal to those shown in Pratt & Whitney Co.'s Catalog 7, pages 87, 88 and 89; miscellaneous saws, equal to saws shown on page 115, Henry Disston & Sons' Lumbermen's Handbook of April, 1914, and 18 sets of dies, ¾ to 1 in., for 2 in. machine, equal to those shown on page 96, Catalog E, National Machinery Co. Until Aug. 30.

Md., Baltimore—F. M. Herring, 815 West Strickler St.—lathes and auto repair equipment.

Md., Baltimore—Miller Safe & Lock Co., Fremont and Briscoe Sts., A. Kessler, Purch. Agt.—
One large open side planer, 48 x 48 x 14 ft.
Two 6 ft. radial drills.
One 24 in. shaper.
One 28 in. shaper.
One large punch.
Miscellaneous small drill presses.

Md., Baltimore—The Monumental Machine Co., Inc., 3505 Elliott St., L. Muthert, Purch. Agt.—large drill press with 36 in. table (used).

N. J., Plainfield (P. O. Box 721)—one planer, 7 ft. wide, 6 ft. high, with short stroke, two side heads and two rail heads (used)..

N. J., Trenton—The Mercer Automobile Co., Whitehead Road—universal grinding machines.

N. Y., New York (Borough of Manhattan) —Hope & Sons, 103 Park Ave.—one bench shear about 40 in. long.

Pa., Lewistown—The Keystone Motor Co. —garage equipment.

Pa., Philadelphia—The Automatic Fuel Service, Bulletin Bldg. — machine shop equipment.

Pa., Philadelphia—The J. G. Duncan, Jr., Co., 1228 Race St.—garage equipment.

Pa., Philadelphia—T. R. Humphrey, 245 North 11th St.—garage equipment.

Pa. Philadelphia—The Standard Steel Bearings Co., 500 North Broad St.—one No. 2 Brown & Sharpe universal grinder.

Pa., Sellersville—The United States Gage Co., W. H. Lentz, Purch. Agt. — one 2 spindle drill, or drill and tapping head, spindle to be adjusted for various angles from 58 to 90 degrees between centers, drills for this machine to be ⅛ in. to ¼ in. in diameter.

Tenn., Chattanooga—The J. C. Vance Iron & Steel Co.—one combination bar and angle shear.

Va., Richmond—F. L. Benton, 2043 West Broad St.—one drill press and one lathe.

Va., Richmond—The Lloyd Motor Co., 315 West Main St., M. R. Lloyd, Purch. Agt.—lathes, drill presses and repair machinery.

Va., Richmond—The Mullin Motor Garage Co., 436 West Main St., L. A. McMullin, Purch. Agt.—drill press, 14 in. lathe and emery wheels.

Ill., Chicago—The Illinois Central Ry., Office of Purch. Agt., Park Row Station—
Two 20 in. x 10 ft. engine lathes.
Two 18 in. x 10 ft. heavy duty engine lathes.
One 36 in. x 18 ft heavy duty engine lathe.
Four 24 in. x 14 ft. heavy duty engine lathes.
Two 14 in. x 14 ft. heavy duty engine lathes.
Four 42 in. x 6 ft. portable engine bolt lathes.
Four 42 in. high duty vertical drills.
One 2½ in. x 24 in. turret lathe.
One 2 in. x 24 in. turret lathe.
One 42 in. sliding head vertical drill
One 42 in. sliding head vertical drill press.
Three 21 in. heavy pattern sliding head upright drills.
One 1⅛ in. Acme double bolt cutter.
One 24 in. heavy duty crank shaping machine.
One 48 in. x 48 in. x 30 ft. heavy duty planing machine with double heads on cross rail and two side heads.
One 5 ft. plain heavy duty radial drill press.
One 24 in. heavy duty slotting machine.
Two No. 3 universal high power milling machines.
One 28 in. heavy duty crank shaping machine.
One 20 in. tool room crank shaping machine.
Five 6 in. high duty power hack saws.
One 14 in. single spindle friction drill, ¾ in. hole.
Two No. 2 universal cutter and reamer grinders.
Nineteen double floor grinders with tw 18 x 3 x 1¼ in. grinding wheels.
One 18 in. to 75 in. throat pneumatic bull riveter.
All machines to be power driven, 220 v. or 40 c., 60 cycle, 3 ph., either Westinghouse or General Electric equipment; machines to be distributed among various shops.

Ill., Chicago—E. F. Menkin, 662 West Grand St.—one small screw machine.

Mich., Detroit—The Amer. Machine Products Co., 18th and Howard Sts.—miscellaneous machine shop equipment.

Mich., Detroit—The Barnes Scale Co., 1221 John R. St.—one hand screw machine to take work 1¼ in. in diameter.

Mich., Detroit—T. Goodfellow, 518 5th St. —miscellaneous repair equipment.

Mich., Detroit—The Handy Governor Corp., 686 Grand River Ave., R. G. Handy, Purch. Agt.—J. H. Lapointe broaching machine, size 1 or 2 (used).

Mich., Detroit—J. A. Lacklin, c/o P. R. Rossello, Archt., 406 Congress Bldg.—service station repair equipment.

Mich., Detroit—The National Alloys Co., Woodbridge St. — miscellaneous foundry equipment.

Mich., Detroit—The Steering Gear and Parts Co., 272 Harper Ave.—Person, Arbor or Heald rotary grinder (used).

O., Cleveland—The Bd. Educ., East 6th St. and Rockwell Ave., F. G. Hogan, Dir. of Schools—manual training equipment.

O., Dayton—The Empire Tool Co., C. H. A. Lange, Purch. Agt.—machine shop equipment.

Wis., Grafton—The Jungers Stove & Range Co.—additional machine tools.

Wis., Milwaukee—The Artbilt Parlor Furniture Co., 2401 Walnut St.—woodworking machinery.

Wis., Milwaukee—The Drop A Line Automobile Copy Holder Co., 523 Prairie St., F. T. Smith, Purch. Agt.—lathe.

Wis., Milwaukee—The Modern Grinder Mfg. Co., 49 Oneida St., A. Strauss, Purch. Agt.—lathes and drill presses.

Wis., Milwaukee—F. Reinke, 1115 Hayes Ave.—sheet metal working machinery and tinner's tools.

Wis., Milwaukee—The Surf Mfg. Co., 109 Clinton St.—pneumatic riveter for riveting ⅛ in. rivets.

Wis., Oconomowoc—E. Otto—one jointer with 12 in. table, one band saw, one rip saw with tilting table and one mitre machine.

Wis., Waukesha—The Waukesha Castings Co., 340 Bway., W. Blair, Purch. Agt. —foundry equipment.

Wis., West Allis—The Nelson Pulley Co., 857 27th St., Milwaukee—lathe, drill press and foundry equipment.

Mo., Kansas City—The Kellum Co.—Turner 32 in. six spindle turret drill press with tapping chuck.

Machinery

The following concerns are in the market for machinery:

Me., Caribou—The Arrostock Federation of Farmers—general equipment for fertilizer plant.

Me., Saco—The Garland Mfg. Co., manufacturers of loom pickers and harnesses—miscellaneous equipment.

Me., Stillwater—The Pierce Mfg. Co.—equipment for planing mill.

Conn., Bridgeport—The Bilton Machine Tool Co.—one 15 ton locomotive crane, with magnet and clamshell bucket.

N. Y., New York (Borough of Manhattan) —The Foundation Co., 233 Bway.—one 5 ton hand power crane with a 35 ft. span.

Pa., Philadelphia—The Amer. Coal and Ice Co., I. Stevens, 4651 Paul St., Purch. Agt.—machinery for the manufacture of ice.

Ky., Henaerson—The Canoe Creek Coal Co.—electrical equipment and coal mining machinery.

Ky., Louisville—The Louisville Chemical Co.—machinery for new factory.

Va., Richmond—H. F. Carter, 2043 West Broad St., H. F. Carter, Purch. Agt.—emery wheels (new or used).

Va., Richmond — The Colonial Pressing and Cleaning Co., 1639 West Broad St., L. S. Chatham, Mgr.—steam pressing machinery, Hoffman preferred (new or used).

Va., Richmond—The Dethol Mfg. Co.—special machinery for manufacture of disinfectants.

Va., Richmond—The Jefferson Tire and Rubber Co., Central Bank Bldg., R. C. Slayton, Purch. Agt.—about $175,000 worth of equipment.

Ill., Chicago—A. Finkel & Sons Co., 1326 Cortland St.—machinery for heat treating.

Ill., Chicago — A. M. Stoehr, 844 North Wells St.—woodworking machinery.

O., Columbus—The Columbus Blank Book Co., 317 South High St., H. B. Perkins, Genl. Mgr.—power cylinder press and two ruling machines.

Wis., Madison—Madison Gas & Electric Co., 126 Main St.—Mono rail crane.

Wis., Milwaukee—The C. Hennecke Co., 1353 North Pierce St.—traveling crane.

Mo., St. Louis—Elliot & Gutweiler, 576 De Balivere Ave., A. Elliot, Purch. Agt.—two electrically operated steam rollers, 36 in. to 72 in. long, for use in waterproofing fabrics.

Neb., Omaha — The Baker Ice Machine Co., 19th and Nicholas Sts.—machinery for the manufacture of ice.

Ont., Lovat—The Lovat Brick & Tile Co.—machinery for manufacture of tile.

Metal Working

NEW ENGLAND STATES

Conn., Bridgeport—A. Aldo, 1699 Madison Ave., will build a 1 story, 100 x 110 ft. garage on North Ave. and Sedgewick St. Estimated cost, $50,000. Noted Aug. 12.

Conn., Bridgeport—W. Levine, 108 Reilly St., will build a 1 story, 50 x 60 ft. garage on Pembroke St. Estimated cost, $15,000.

Conn., Hartford—The Arron Electric Co., 99 Hawthorne St., has awarded the contract for the construction of a 1 story, 35 x 40 ft. addition to its plant. Estimated cost, $9,000.

Conn., Hartford — M. W. DeLaney, 77 Greenfield St., has awarded the contract for the construction of a 1 story, 60 x 118 ft. garage on High St. Estimated cost, $30,000. Noted July 15.

Conn., Manchester—The Valvoline Oil Co., Main St., will build a 1 and 2 story, 60 x 100 ft. garage on Stockhouse St. Estimated cost, $25,000.

Conn., Meriden—The International Silver Co., 48 State St., has awarded the contract for the construction of alterations and a 4 story addition to its factory. Estimated cost, $25,000.

Me., Knightsville—The Knightsville Garage plans to build a 1 story, 49 x 100 ft. garage on B St. Estimated cost, $14,000. Private plans.

Mass., Greenfield — The Greenfield Tap and Die Corp., Sanderson St., is having plans prepared by Harris & Richards, Archts. and Engrs., Drexel Bldg., Philadelphia, for the construction of a 5 story addition to its plant.

Mass., Lynn — G. Gianimo, 68 Tremont St., plans to build a 1 story, 60 x 90 ft. garage. Estimated cost, $25,000. Sanborn & Weed, 38 Exchange St., Archts.

Mass., Lynn—J. Iverson, 463 Broad St., has awarded the contract for the construction of a 1 story garage on Pleasant and Broad Sts. Estimated cost, $10,000.

Mass., Methuen — The Arlington Mills, Lawrence, Mass., has awarded the contract for the construction of a 1 story, 52 x 100 ft. garage on Kirk St. here. Estimated cost, $25,000.

Mass., Stoughton—The Norris Noiseless Pedal Action Co., French St., has awarded the contract for the construction of a 1 story building for the manufacture of piano supplies. Estimated cost, $18,000.

Mass., Turners Falls—The Greenfield Tap and Die Corp., Sanderson St., Greenfield, is having plans prepared for the construction of a 1 story forge shop addition to its plant here. Estimated cost, $50,000.

Mass., Worcester — The Reed & Prince Mfg. Co., Duncan Ave., has had plans prepared for the construction of a 1 story, 60 x 110 ft. auditorium, and a 1 story, 30 x 65 ft. and a 3 story, 62 x 118 ft. factory for the manufacture of machinery. Cost between $150,000 and $200,000.

Mass., Worcester—D. Shapiro, c/o E. T. Chapin, Archt., 340 Main St., plans to build a 1 story garage on Harding St. Estimated cost, $25,000.

R. I., Providence—R. T. Slade, 147 Elmwood Ave., has awarded the contract for the construction of a 1 story, 62 x 102 ft. garage and service station. Estimated cost, $50,000.

R. I., Valley Falls — The Standard Nut and Bolt Co. will soon award the contract for the construction of a 1 story, 60 x 80 ft. factory. Estimated cost, $20,000. A. H. Humes, Valley Falls, Archt.

MIDDLE ATLANTIC STATES

D. C., Washington—The Bureau of Yards and Docks, Navy Dept., will receive bids until Sept. 1 for the construction of a mechanics' shop, filling house, shell house and magazine.

N. J., Trenton — The Amer. Bridge Co., South Warren St., will build five 1 story additions to its iron plant. Estimated cost, $33,500.

N. Y., New York (Borough of Brooklyn)—J. Robinowitz, 363 Amboy St., will build a 1 story, 100 x 100 ft. garage on Pacific St. near New York Ave. Estimated cost, $30,000.

N. Y., New York (Borough of Brooklyn)—J. Shapiro, c/o P. Caplan, Archt., 16 Court St., will build a 1 story, 100 x 100 ft. garage on Warren St., near 3d Ave. Estimated cost, $30,000.

N. Y., New York (Borough of Brooklyn)—The Skiaberg Realty Co., c/o Cohn Bros., Archts., 361 Stone Ave., will build a 1 story, 100 x 100 ft. garage on Pulaski St. and Nostrand Ave., also a 1 story, 95 x 150 ft. garage on President St. near 3d Ave. Estimated cost, respectively, $35,000 and $30,000.

N. Y., New York (Borough of Brooklyn)—J. Shapiro, c/o P. Chapin, Archt., 16 Court St., will build a 1 story, 50 x 75 ft. garage on Snediker Ave., near Livonia Ave. Estimated cost, $12,000.

N. Y., New York (Borough of Brooklyn)—B. Weiner, 496 Hopkins St., will build a 1 story, 100 x 100 ft. garage on Fulton St. Estimated cost, $25,000.

N. Y., New York (Borough of Brooklyn)—West Church Realty Co., 44 Court St., will build a 1 story, 100 x 100 ft. garage on Livonia Ave., between Van Senderen and Snediker Aves. Estimated cost, $40,000.

N. Y., New York (Borough of Queens)—J. Dockoeller, 179 Weirfield St., Brooklyn, will build a 1 story, 95 x 100 ft. garage on Jamaica Ave., Long Island City. Estimated cost, $25,000.

Pa., Lewistown—The Keystone Motor Co. is preparing plans for the construction of a 2 story, 181 x 201 ft. garage. Estimated cost, $20,000. Stearns & Woodnut, St. Girard Bldg., Engrs. and Archts.

Pa., Philadelphia—The J. G. Duncan, Jr., Co., 1228 Race St., will soon award the contract for the construction of a 2 story, 20 x 100 ft. sales and service building at 661 North Broad St. Estimated cost, $15,000. MacKenzie & Wiley, R.E.V. Bldg., Archts.

Pa., Philadelphia—T. R. Humphrey, 245 North 11th St., has awarded the contract for the construction of a 1 story, 70 x 100 ft. garage at 1022 Spring St. Estimated cost, $16,000.

Pa., Philadelphia — Nicholas Nasife & Son, 3729 Old York Rd., will soon award the contract for the construction of a 1 story, 60 x 110 ft. garage. Estimated cost, $10,000. Private plans.

SOUTHERN STATES

Va., Richmond—The Frost & Beveredge Co., 14th and Cary Sts., has awarded the contract for the construction of a 2 story, 28 x 120 x 140 ft. garage on Lodge and Byrd Sts. Estimated cost, $55,000.

MIDDLE WEST

Ill., Chicago—J. Burick, 2544 Millard St., plans to build a 1 story, 25 x 102 ft. garage. Estimated cost, $10,000. F. Randak, 3643 West 26th St., Archt.

Ill., Chicago—A. Finkel & Sons Co., 1326 Cortland St., has awarded the contract for the construction of a 1 story, 32 x 98 ft. heat treating plant. Estimated cost, $20,000.

Ill., Chicago — A. Hallgren, 7018 Perry Ave., has awarded the contract for the construction of a 1 story, 50 x 67 ft. garage at 5631 South State St. Estimated cost, $30,000.

Ind., Hammond—The Metals Refining Co., Inc., is building a lead smelting plant. W. Wilke, Jr., Hammond, Engr.

Mich., Detroit — The Amer. Machine Products Co., 18th and Howard Sts., will soon award the contract for the construction of a 1 story, 65 x 100 ft. factory for the manufacture of machine parts. Estimated cost, $45,000. Baxter, O'Dell & Halpin, 1024 Hammond Bldg., Archts.

Mich., Detroit—The Blodgett Eng. and Tool Co., Kerr Bldg., will soon award the contract for the construction of a 4 story factory on Dalzelle St. Estimated cost, $50,000. A. E. Harley, 435 Woodward Ave., Archt.

Mich., Detroit—T. Goodfellow, 517 5th St., is having plans prepared for the construction of a 2 story, 70 x 80 ft. garage at 5th and Marcy Sts. Estimated cost, $25,000. Mildner & Eisen, 924 Hammond Bldg., Archts.

Mich., Detroit—J. A. Lacklin, c/o P. R. Rossello, Archt., 406 Congress Bldg., is having plans prepared for the construction of a 1 story, 65 x 120 ft. service station on Bewick Ave. Estimated cost, $35,000.

Mich., Detroit — The Natl. Alloys Co., Woodbridge St., plans to build a 1 story, 60 x 100 ft. foundry. Estimated cost, $25,000. H. H. Lane, Dime Bank Bldg., Detroit, Engr.

Mich., Detroit—The Weyhing Bros., 235 Woodward Ave., will receive bids until Aug. 20, for the construction of a 2 story, 45 x 96 ft. factory on Field and Forest Sts. for the manufacture of jewelry. Estimated cost, $100,000. Baxter, O'Dell & Halpin, 1024 Hammond Bldg., Archts.

O., Cleveland—The Ansonia Co., 1113 Schofield Bldg., has had plans prepared by T. C. Minor, Archt., 1832 East 79th St., for the construction of a 1 story, 18 x 100 ft. garage at 1644 Ansel Rd. Estimated cost, $10,000.

O., Cleveland—The Bd. Educ., East 6th St. and Rockwell Ave., will soon award the contract for the construction of a 1 story, 50 x 200 ft. addition to its school on Bway. and South High St., to include a manual training department. Estimated cost, $150,000. F. G. Hogan, Dir. W. R. McCormick, c/o owner, Archt.

O., Cleveland—The Cleveland Can Co., 1836 Euclid Ave., plans to build a 3 story factory. Estimated cost, $200,000. J. A. Brown, Mgr.

O., Cleveland—J. Feigenbaum, 541 Society for Savings Bldg., plans to build a 2 story, 50 x 150 ft. garage on East 9th St. and Lakeside Ave. Estimated cost, $100,000.

O., Cleveland — G. Huberty, 1427 East 45th St., has awarded the contract for the construction of a 1 story, 32 x 68 ft. addition to his factory for the manufacture of bar and store fixtures. Estimated cost, $25,000.

O., Cleveland — The Kaynee Co., Aetna Rd. and Bway., has awarded the contract for the construction of a 1 story, 60 x 180 ft. factory and garage. Estimated cost, $75,000. E. C. Seitz, Secy. Noted Aug. 12.

O., Cleveland — H. Lohrey, 2236 East Cedar St., Pittsburgh, has awarded the contract for the construction of a 1 story, 40 x 122 ft. garage at 1375 East 33d St. here. Estimated cost, $40,000.

O., Cleveland—The Ohio Bronze Powder Co., 1120 East 152d St., plans to build a 2 story factory. Estimated cost, $50,000. G. F. Glass, Pres. Private plans.

O., Coldwater—The New Idea Spreader Co. has awarded the contract for the construction of a 2 story, 48 x 200 ft. factory and a 2 story, 48 x 200 ft. warehouse. Estimated cost, $100,000.

O., Lakewood — The Lakewood Garage Co., c/o J. DeClair, 1355 West 116th St., has awarded the contract for the construction of a 1 story, 40 x 75 ft. garage. Estimated cost, $20,000.

O., Minster—The Minster Machine Co. is preparing plans for a 1 story, 37 x 100 ft. addition to its factory. Estimated cost, $10,000.

O., Norwood — The Cincinnati Machine Tool Co., Waverly Ave., has awarded the contract for the construction of a 1 story, 50 x 146 ft. addition to its machine shop. Estimated cost, $50,000.

O., Piqua—The Champion Fdry. Co. has awarded the contract for the construction of a 2 story factory. Estimated cost, $45,000.

Wis., Grand Rapids—The Grands Rapids Fdry. Co. will build a 1 story, 50 x 104 ft. pattern storage shop. O. R. Roenius, Mgr.

Wis., Lake Mills—The Pirwitz Motor Co., c/o F. Pirwitz, Pres., plans to build a 4 story, 60 x 150 ft. garage on Main and Madison Sts.

Wis., Manitowoc—The Clark Oil Co., c/o T. Clark, Mgr., is having plans prepared for the construction of a 2 story, 60 x 110 ft. garage and service station on York and 10th Sts. Juul & Smith, Imig Bldg., Sheboygan, Archts.

Wis., Milwaukee—The C. Hennecke Co., 1353 North Pierce St., plans to build a 1 story steel fabricating plant on Port Washington Rd.

Wis., Waukesha—The Standard Oil Co., Waldheim Bldg., Milwaukee, will soon award the contract for the construction of a 1 story, 50 x 90 ft. garage and warehouse. Estimated cost, $40,000.

Wis., West Allis—The Nelson Pulley Co., 857 27th St., Milwaukee, will build a 1 story, 60 x 120 ft. machine shop and foundry.

WEST OF THE MISSISSIPPI

Iowa, Centerville—The Judy Mfg. Co. has awarded the contract for the construction of a 1 story, 60 x 150 ft. foundry. Estimated cost, $30,000.

Minn., Minneapolis—The Hennepin Atomized Fuel Co. is building a plant on Bway. and Johnson Sts., N.E., and will probably install a machine shop.

Minn., Pine Island—Bd. Educ. plans to build a 2 story, 60 x 106 ft. high school, to include a manual training department. L. L. Cornwell, Secy. Stebbins & Haxby, 445 Auditorium Bldg., Archts.

Mo., Joplin—The Mchy. and Supply Co. plans to build a machine shop and warehouse. Estimated cost, $200,000.

Mo., Kansas City — Lester & Farrell, c/o F. Lester, 1612 Benton Blvd., has awarded the contract for the construction of a 1 story, 90 x 120 ft. garage and boiler room. Cost between $27,000 and $30,000.

Mo., St. Louis—The Advance Electric Co., 6315 Maple Ave., has awarded the contract for the construction of a 1 story, 50 x 100 ft. addition to its factory. Estimated cost, $15,000.

Mo., St. Louis—The Schlueter Mfg. Co., Bway. and John Ave., will soon award the contract for the construction of a 4 story, 83 x 104 ft. warehouse and machine shop on North Bway. Estimated cost, $100,000. F. May, Laclede Bldg., Archt.

N. D., Devil's Lake — The Northwestern Iron Works will build a machine shop and foundry. S. A. Hann, Pres.

WESTERN STATES

Utah, Provo—The Utah Coal Road & Salt Lake Route will soon receive bids for the construction of a 1 to 3 story, 75 x 240 ft. shop. Estimated cost, $200,000. F. Strong, Div. Engr.

General Manufacturing

NEW ENGLAND STATES

Me., Caribou—The Arrostock Federation of Farmers will soon award the contract for the construction of a 60 x 250 ft. fertilizer plant. Estimated cost, $50,000. P. J. Sullivan, 74 Broad St., Boston, Mass., Engr.

Me., Stillwater—The Pierce Mfg. Co. will build a 40 x 40 ft. planing mill.

Mass., Boston — The W. F. Schrafft & Sons Corp., 160 Washington St., N., has awarded the contract for the construction of a 3 story, 80 x 240 ft. building on Causeway St. for the manufacture of confectionery. Estimated cost, $250,000. Noted July 22.

Mass., East Everett—The Carpenter Morton Co., 77 Sudbury St., Boston, has awarded the contract for the construction of a 4 story, 50 x 60 ft. factory on East Summer St. for the manufacture of paint. Estimated cost, $75,000.

Mass., Stoughton — The Panther Rubber Co., Suffolk St., Chelsea, will build a 2 story, 60 x 70 ft. addition to its plant on Monk St. here. Estimated cost, $35,000.

N. H., Peterboro—The Peterboro Co. has awarded the contract for the construction of a 1 story, 200 x 225 ft. factory for the manufacture of textiles. Estimated cost, $125,000.

R. I., Pawtucket—The What Cheer Chemical Co., Grotto Ave., will build a 1 story addition to its factory on Plant St. Estimated cost, $35,000.

R. I., Providence — The Waldorf Lunch Co., c/o J. M. Gray, Archt., 112 Water St., Boston, Mass., will soon award the contract for the construction of a 1 story addition to its bakery on Bryon St. here. Estimated cost, $50,000.

MIDDLE ATLANTIC STATES

Md., Crisfield — The Potomac Poultry Food Co., 802 Keyser Bldg., Baltimore, plans to build a 1 story, 125 x 144 ft. plant. Estimated cost, $150,000. H. F. Doeleman, 507 North Charles St., Engr.

N. J., Hoboken — The Chocolate Manier Co. will soon award the contract for the construction of a 2 story factory on Clinton St. Estimated cost, $100,000. Ballinger & Perrott, 47 West 34th St., New York City, Engrs. and Archts.

N. J., Jersey City—The Continental Candy Co., 585 Bergen Ave., has awarded the contract for the construction of a 3 story factory on Claremont Ave. Estimated cost, $25,000.

N. Y., New York (Borough of Brooklyn) —The Levine Bros., c/o W. Higginson, 18 East 41st St., New York City, will build a 1 story candy factory on 9th St. here. Estimated cost, $35,000.

Pa., Philadelphia—The Tasty Baking Co., 2335 Sedgely Ave., will soon award the contract for the construction of a 1 story, 101 x 101 ft. addition to its bakery on Hunting Park and McMichael St. Private plans.

Pa., Spring City — The State Inst. for Feeble Minded, Easton, will receive bids until Aug. 24 for the construction of a 1 story, 40 x 180 ft. dairy. Estimated cost, $200,000. P. H. Johnson, 1713 Sansom St., Philadelphia, Engrs. and Archts.

Pa., Williamsport — The Dewart Milk Products Co., Inc., Dewart, Pa., plans to build a 3 story, 110 x 170 ft. depot on Erie and 3d Aves. Estimated cost, $100,000.

SOUTHERN STATES

N. C., Forest City—The Florence Mills plans to build a 3 story, 50 x 80 ft. cotton mill. J. E. Sirrine, Greenville, S. C., Engr. and Archt.

Tenn., Knoxville—The Brookside Mills Co. has awarded the contract for the construction of a 1 story weave shed at its factory on Plant St. Estimated cost, $300,000.

Tenn., Knoxville—The Holston Mfg. Co. has awarded the contract for the construction of a hosiery factory and dye house.

Va., East Richmond (Richmond P. O.)— The Jefferson Tire and Rubber Co., Central Bank Bldg., Richmond, has had plans prepared by the Akron Eng. Co., Archts and Engrs., Akron, O., for the construction of a 3 story, 80 x 240 ft. factory here. Estimated cost, $150,000.

MIDDLE WEST

O., Cleveland—The American Turpentine Co., 136 Engineers' Bldg., is having plans prepared for the construction of a 1 and 3 story, 100 x 180 ft. factory and 24 x 40 ft. boiler house along the tracks of the Beltline Ry. Estimated cost, $200,000. H. D. Tremmel, Secy.

O., Cleveland—The Cleveland Society for the Blind, 2275 East 55th St., will soon award the contract for the construction of a 2 story, 40 x 80 ft. factory. Estimated cost, $35,000. E. B. Palmer, Secy.

O., Cleveland—The Hoffman Candy Co., 10522 Cedar Ave., has awarded the contract for the construction of a 1 story, 50 x 53 ft. factory. Estimated cost, $15,000.

O., Cleveland—The J. Spang Baking Co., 2711 Barber Ave., is having plans prepared for the construction of a 3 story, 70 x 125 ft. bakery. Estimated cost, $100,000. E. Huberty, 8017 Whitethorne Ave., Archt. J. Spang, Pres.

O., Columbus—The Columbus Blank Book Co., 317 South High St., has awarded the contract for the construction of a 2 story, 30 x 75 ft. factory. Estimated cost, $50,000.

O., Columbus—The Federal Chemical Co., 1200 Bonham Ave., has awarded the contract for the construction of a 122 x 167 ft. addition to its fertilizer factory. Estimated cost, $100,000.

O., Greenville—The Greenville Gravel Co. has awarded the contract for the construction of a 2 story, 80 x 120 ft. lumber mill, etc., on Jackson St. Estimated cost, $100,000.

O., Urbana—The United Paper Board Co. is having plans prepared for the reconstruction of its plant.

Wis., Menasha—The Simple Gas Engine Works will build a 60 x 100 ft. foundry. F. J. Oberweiser, Pres.

Wis., Oconto—The Hold Lumber Co. will build a 1 story, 40 x 50 ft. plant. Estimated cost, $75,000.

Wis., Sheboygan—The Columbia Rubber Mills, c/o L. Hofmeister, 176 16th St., Milwaukee, is having plans prepared for the construction of a 2 story, 70 x 200 ft. factory on Lyman St. Cost, $50,000 to $75,000. Juul & Smith, Imig Bldg., Archts. E. Juul, 805 North 8th St., Engr.

Wis., Sheboygan—The Excelsior Wrapper Co., 1635 Erie Ave., has awarded the contract for the construction of a 3 story, 80 x 130 ft. factory. Estimated cost, $30,000. Noted Dec. 11.

WEST OF THE MISSISSIPPI

Mont., Forsyth—A company has been organized with $1,500,000 capital stock and plans to build a sugar factory here. J. E. Edwards, Pres.

Neb., Omaha — The Baker Ice Machine Co., 19th and Nicholas Sts., plans to build a factory. Estimated cost, $200,000.

CANADA

Ont., Lovat—The Lovat Brick & Tile Co. plans to build a brick and tile plant to replace the one which was destroyed by fire. Estimated cost, $20,000.

Que., Montreal — The Canadian Rubber Co. Ltd., Inspector St., has awarded the contract for the construction of a 1 story, 40 x 50 ft. factory, on Notre Dame St. E. Estimated cost, $12,000.

NEED COMPETENT MEN?
See SEARCHLIGHT SECTION
Pages 312-349 Pages 312-349